# BROOKLINE GREEN ROUTES BICYCLE NETWORK PLAN

Brookline Bicycle Advisory Committee

March 2023

# Contents

# 1. Introduction

The Brookline Bicycle Advisory Committee (BAC) is pleased to present this update to the Brookline Green Routes Bicycle Network Plan. The Plan was first developed and accepted as a Town document in 2008. Since that time numerous important measures have been implemented by the State and the Town that improve transportation planning and bicycling. This document incorporates a mix of original content and updates contributed at different times by multiple authors. The 2022 version was substantially updated with relevant new information and reorganized to improve readability; this edition continues BAC's tradition of annual updates.

This section highlights key recommendations and current projects. Section 2 presents the Green Routes Bicycle Network, a plan to enable people of all ages and abilities to bike safely and comfortably throughout town. Section 3 describes Brookline's progress toward accomplishing this vision. Section 4 identifies the next steps needed to establish the network. Appendix A describes examples of facilities that can improve bicycle safety. Appendix B lists streets where bicycle accommodations are recommended or have been implemented. While this report primarily considers bicycles, its recommendations apply nearly equally for other micromobility vehicles, as discussed in Appendix C.

Bicycling is a sustainable, economical, and convenient mode of transportation for short and medium distance trips, and a popular recreation for people of all ages. Bicycling is good for the environment and public health, reduces motor traffic congestion, and eases parking demand. The Green Routes network proposed here can enable residents to safely shop and run errands using bicycles and allow young people to safely bicycle to school and athletic fields. Greenways can connect areas of town, benefitting bicycle and micromobility users, walkers, and joggers alike. Families can enjoy riding along Green Routes, with easy access to the Town's open spaces and regional off-road paths. Safe routes to Green Line T stops, some of which have Bluebikes stations, and many of which have bike racks, can encourage combining bicycle and transit use. Improving bicycle infrastructure helps the Town work toward its zero emissions and sustainable transportation goals.

This report uses the following definitions:

**Bicycle** – traditional bicycles, ebikes, tricycles, passenger, and cargo bicycles. Bicycle and bike are used interchangeably.

**Micromobility vehicle** – bicycles as well as moderate-speed, human- or electric-powered transportation, generally for single users, including scooters and e-scooters. Appendix C discusses micromobility.

**Motor vehicle** - cars, trucks, buses, and motorcycles. Motor vehicle and car are used interchangeably.

Brookline has many favorable characteristics for bicycling such as compact development, proximity to major employment centers, and gentle topography. According to US Census

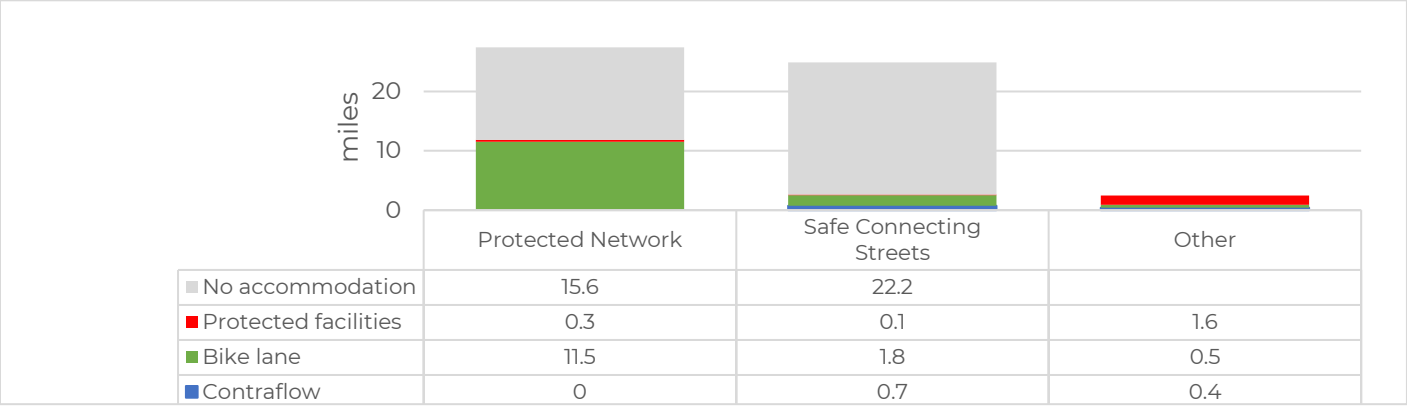
data, between 2000 and 2010, bicycle commuter trips in Brookline increased from 1.5% to 4%. Bicycle counts at 18 checkpoints conducted by BAC each September showed peak hour bicycle use increasing from 1,100 in 2008 to 2,100 in 2019, although dropping following the Covid pandemic, with 1,500 bikes counted in 2022. From 2018 through 2022 (excluding 2020) an average of 100 parked bicycles were counted at Brookline High School (BHS).

Brookline has participated in the Bluebikes bike share program since 2012, enhancing bicycle access for residents and visitors. Between 2019 and 2022, Bluebikes trips originating in Brookline increased 71% from 62,000 to 105,000 (289 trips per day).

The terms “bicycle user”, “cyclist”, “rider”, and “biker” are used interchangeably to emphasize that the Green Routes network offers year-round transportation and recreation opportunities for the entire community. It also serves enthusiasts who ride for sport, but its primary purpose is to make bicycling accessible for all.

Although some cyclists mix comfortably with moderate speed motor traffic, much of the population is traffic-intolerant. Most people don’t mind riding on low-speed, low-traffic local streets. However, on high-speed or high-volume streets, most people want to be separated from the stress of sharing space with motor traffic when on bicycles. The Green Routes plan accommodates traffic-intolerant bicycle users by offering separation from motor traffic using a variety of designs. In addition to identifying off-road paths such as the Muddy River path and encouraging travel along residential streets with low traffic volumes and speeds, the Green Routes plan includes various roadway treatments. Descriptions of these options can be found in Appendix A and in Cambridge’s Bicycle Facility Toolbox, which lists examples of bicycle facilities being built and planned across the metropolitan area.

Brookline has 145 miles of roadway. The Green Routes plan designates 27 miles of those roads as belonging to the proposed “Protected Network”, and another 25 miles as “Safe Connecting Streets.” Figure 1 categorizes the town’s existing 17 miles of bicycle accommodations in relation to the proposed network. Figure 2 and Appendix B describe these facilities in detail.

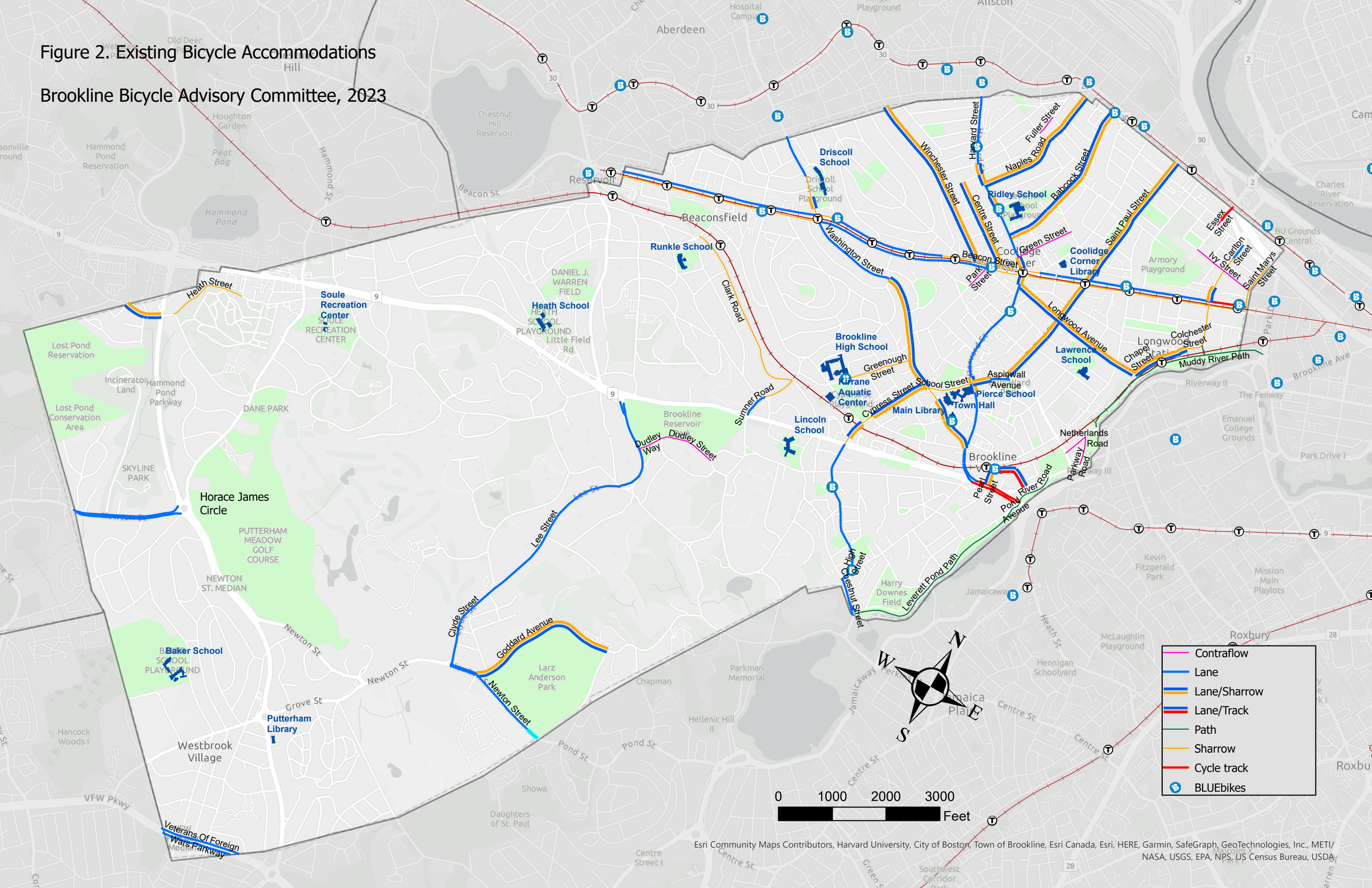



| | Protected Network | Safe Connecting Streets | Other |
|---|---|---|---|
| No accommodation | 15.6 | 22.2 | |
| Protected facilities | 0.3 | 0.1 | 1.6 |
| Bike lane | 11.5 | 1.8 | 0.5 |
| Contraflow | 0 | 0.7 | 0.4 |

Figure 1. Existing bicycle accommodations

Figure 2. Existing Bicycle Accommodations

Brookline Bicycle Advisory Committee, 2023



The Town's FY2023-2028 Capital Improvement Program plan allocates $1.3M for bicycle access improvements over six years. However, bicycle use presently remains well below its potential and does not meet the criteria of the Town's 2016 Complete Streets Policy. We have failed to keep pace with national trends in creating bicycle-friendly routes. Among our neighbors, Boston has announced a goal of increasing bicycling fourfold by 2030, Cambridge plans to implement a network of protected bike lanes by 2026, and Somerville has added numerous protected lanes and is increasingly prioritizing buses, bikes, and pedestrians. The remainder of this section summarizes key recommendations, recent improvements, and projects currently budgeted for 2023 or under study.

## Key recommendations for improving bicycling

- Develop a multiyear plan of specific bicycle-related initiatives to expand protected lanes on major routes and effectively connect with neighboring communities' bicycle networks.
- Maintain the quality and safety of existing bike lanes.
- Prioritize key bike routes with degraded pavement for bonded wearing courses (i.e., interim repair of the existing surface) or comparable surface improvements where major resurfacing is not planned for three or more years.
- Improve signage and waymarking to safely guide people to key destinations in Brookline as well as to downtown Boston, Cambridge, Newton, Longwood Medical Area, the Charles River, and the Emerald Necklace.
- Increase use of temporary and pop-up protected lanes, such as those implemented in 2020. These provide quick, immediate improvements, facilitate measuring effectiveness, and help inform and prioritize permanent improvements.
- Identify candidate shared space streets and implement pilot programs in different parts of town such as Pleasant Street, Brook Street, Clark Road, and Beverly Road.
- Continue to identify and implement contraflow routes.

## Projects implemented in 2022

**Beacon Street eastbound after Washington Street.** Bollards and water-filled jersey barriers were installed to discourage vehicles from blocking the separated bike lane.

**Washington Street from Cypress Street to Beacon Street.** A bonded wearing course was applied. Pavement markings will establish continuous bike lanes, bike boxes, and other improvements.

**Washington Street west of Jamaicaway**. Traffic signal timing on the Emerald Necklace Crossing at Washington Street was altered to be one-half cycle. Timing for pedestrians, bicycles, and micromobility users was reduced from 2-minute to 1-minute cycles. The adjustments were based on a Transportation Division study conducted in cooperation with BAC and Professor Peter Furth of Northeastern University.

## 2023 projects

**Harvard Street between Beacon Street and Green Street**. Surface mount bollards were installed along the white lane line separating the bike lane and the right travel lane in February 2023. Transportation Division staff will seek feedback from the community assessing the effectiveness of this constrained separation.

Three projects were budgeted for 2022, but delayed to 2023.

- Buffered bike lanes will be installed in each direction as part of a pavement preservation project for Allandale Road.
- Protected contraflow lanes will be installed near Brookline High School on segments of Davis Avenue, Greenough Street, and Tappan Street.
- The painted bike crossing adjacent to the crosswalk connecting the Green Street contraflow lane to Harvard Street southbound will be improved.

## Projects in design or under study

Restoration of Frederick Law Olmsted's 1896 design for the **Beacon Street Bridle Path** in the center of Beacon Street is proposed as a two-way protected multimodal path with crossovers at major intersections. Toole Design Group performed a restoration feasibility and concept design study**.** The Transportation Board endorsed the Department of Public Works Capital Improvement Program request for $700,000 for FY2024 to fund a consultant contract for preparation of 25% design plans and specifications meeting MassDOT standards including public process.

**Brookline Avenue**. The Transportation Division prepared conceptual plans for a northbound combination marked bike lane and bus-bike lane from just north of Washington Street to the Boston line, as well as a southbound, buffered bike lane from Parkway Road to Pearl Street. The project awaits approval from MASCO and MBTA.

**Chestnut Street.** A two-way separated cycle track between Walnut and Kendall Streets was approved for 2025 Massachusetts Safe Routes to School funding. Because the intersection of Walnut at Kennard/Chestnut does not meet accessibility design standards, the project will likely change. The Town might fund the bike portion so that the grant can be used for the intersection and improvements on Kennard Road.

**Hammond Street/Woodland Road.** The Transportation Board approved a conceptual design for traffic signal and road diet in 2021. It is allocated at $1.5M for FY2025 in the Capital Improvement Program.

**Washington Street project.** A major redesign is proposed from Brookline Village to Beacon Street. A Functional Design Report was prepared by WorldTech Engineering in 2020 followed by a January 2022 public meeting. The project is expected to go through the Massachusetts Department of Transportation (MassDOT) design process to secure federal transportation improvement program funds. A Design Review Committee includes a BAC representative. If approved, construction will begin in 2026 or later.

# 2. Creating a bicycle-friendly community

## Vision for a Green Routes bicycle network

The Bicycle Advisory Committee has identified a conceptual network of safe, low stress, bicycle routes for the Town to use to plan and implement bicycle-related safety improvements. An effective bicycle network provides safe routes for all bicycle users and connects neighborhoods with important local destinations including schools, libraries, parks, and commercial districts. It connects to Green Line T stops and to important bicycling routes at the Town borders, including Beacon Street in Boston and Newton, Commonwealth Avenue, Perkins Street, West Roxbury Parkway, and the Charles River paths. The network has two main components: the **Protected Framework** is comprised of routes that traverse the Town; **Safe Connecting Streets** provide access from these major routes to neighborhoods and key destinations such as schools and parks.

Creating this network requires deliberate planning, budgeting, and focused priorities. Some components can be created at minimal capital expense using road markings and traffic management changes such as parking restrictions, while still maintaining access for people with mobility limitations. Other network components require modest capital improvements such as curb ramps and extensions. Some streets, notably in South Brookline and along the Town's busiest thoroughfares, require major new infrastructure.

The network evolution should be coordinated with planning by Boston, Newton, and the Massachusetts Department of Conservation and Recreation (DCR) to maximize benefit to the entire region. The Go Boston 2030 plan, published in 2017, presents the city's comprehensive plan for all modes of transportation. The 2020 DCR Parkways Master Plan presents bicycle-friendly plans for DCR roads in and adjacent to Brookline. Beacon Street, Harvard Street, Washington Street, Carlton Street and Longwood Avenue are major connectors for cyclists traveling to and from Brookline, Boston, Cambridge, and Newton to Kenmore Square, downtown Boston, Longwood Medical Area, across Brookline, and between Jamaica Plain and Brighton.

The Emerald Necklace passes through Brookline; the Town has been and should continue to cooperate in making road crossings within the Necklace safe for all users. Brookline's central location positions the Town to make significant contributions to linking bicycle accommodations into a regional network through Metropolitan Area Planning Council's Landline plan and LivableStreets Alliance's Emerald Network. Boston, Cambridge, and Somerville have made major strides in recent years to improve conditions for bicycle use; progress in Brookline has been slower.

This plan should complement other Town efforts to improve conditions for cycling, including provisions for bicycle parking, safety education, traffic law enforcement, and ensuring that every street project undertaken or permitted by the Department of Public Works includes reasonable accommodation for bicycles, pedestrians, and those with mobility limitations. One particularly important effort is Brookline's participation in the

Massachusetts Safe Routes to School Program. This program is designed to increase safe biking and walking for elementary and middle school students by using a collaborative, community-focused approach that bridges the gap between health and transportation.

The recommendations for achieving a high-quality network presented here are based on guidelines from the National Association of City Transportation Officials (NACTO). NACTO's Urban Bikeway Design Guide provides guidance for selecting appropriate roadway treatments suitable for bicycle riders of all ages and abilities. Appropriate treatments depend on motor vehicle speeds, volumes, and other factors. NACTO recommends that streets with speeds above 20 mph and volumes above 1,500 annual average daily traffic (AADT) should have dedicated bicycle infrastructure. If providing bicycle infrastructure is not feasible, a 20-mph safety zone speed limit should be established in accordance with state law (Chapter 90, §18B; 2016). MassDOT recommends that "*Safety Zones should be adjacent to locations where vulnerable road users are likely to be present, such as playgrounds, senior citizen housing, hospitals, high schools, and daycare centers. They should be at least one-quarter mile long and contain areas of potential conflict with motor vehicles*." The town's statutory speed limit has been 25 mph since 2018, except in 20 mph safety zones. Appendix A describes roadway treatments and other bicycle accommodations.

## Protected Framework

Streets that establish a safe cycling network on major streets throughout Brookline are assigned the highest priority. This **Protected Framework** identifies routes to schools, parks, business districts and other frequently visited destinations. Routes that connect existing paths, bike lanes and quiet streets are assigned a high priority. The protected framework provides access to key destinations throughout the town:

- Town Hall, the Public Safety Building, the Public Health Building, and the Main Library are located along the triangle defined by Washington Street, Harvard Street, and School Street.
- Coolidge Corner (Beacon and Harvard Streets), Brookline Village (Washington and Harvard Streets), and Washington Square (Washington and Beacon Streets) are principal commercial areas.
- Parks, conservation areas, and recreational facilities including Amory Park, Downes Field, Larz Anderson Park, Lost Pond Sanctuary, Skyline Park, Soule Recreation Center, and Waldstein Playground. Many are on school grounds or adjacent to schools.

This framework consists of the streets with the highest motor traffic volumes, since Brookline's road network lacks low-traffic, low-speed alternatives for crossing town. These projects call for treatments providing physically separate or protected bicycle lanes. Table 1 and Figure 3 describe the Protected Framework, which consists of most Brookline streets with AADT exceeding 6,000 motor vehicles. AADT on these streets ranges from 10,000 to 48,000 on Boylston Street and Washington Street, with an average of 17,000. Appendix B lists projects that would establish the Protected Framework.

Figure 3. Proposed Protected Framework for Safe Bicycling
(Streets with AADT > 6000)

Brookline Bicycle Advisory Committee, 2023

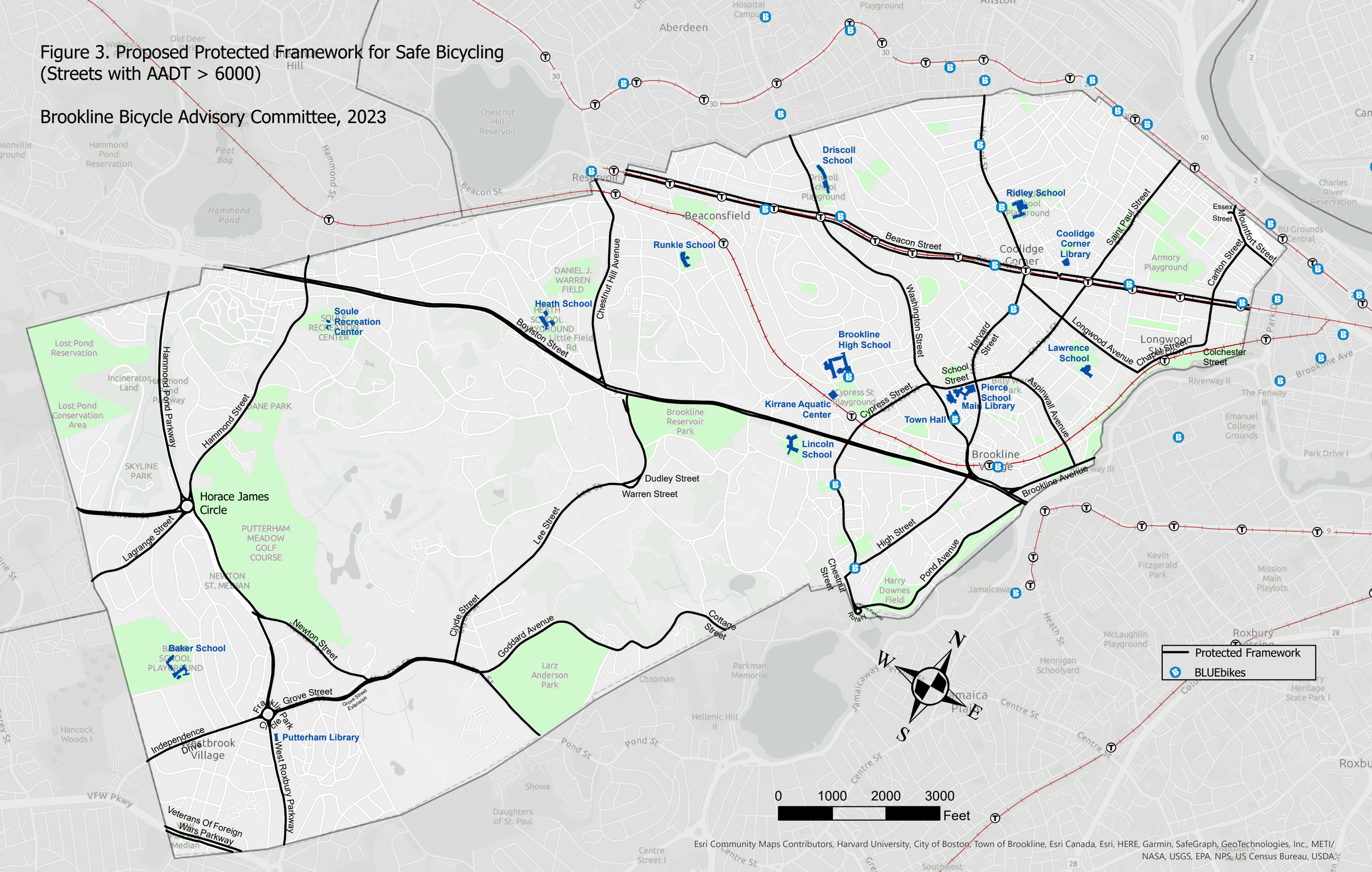


Table 1. Protected Framework

| | | |
|---|---|---|
| Aspinwall Avenue | Cypress Street | Lee Street |
| Beacon Street | Goddard Avenue | Longwood Avenue |
| Boylston Street (Route 9) | Grove Street | Mountfort Street |
| Brookline Avenue | Hammond Pond Pkwy | Newton Street |
| Carlton Street | Hammond Street | School Street |
| Chapel Street | Harvard Street | Saint Paul Street |
| Chestnut Hill Avenue | High Street | Washington Street |
| Chestnut Street | Horace James Circle | West Roxbury Parkway |
| Clyde Street | Independence Drive | |
| Cottage Street | Lagrange Street | |

## Safe Connecting Streets

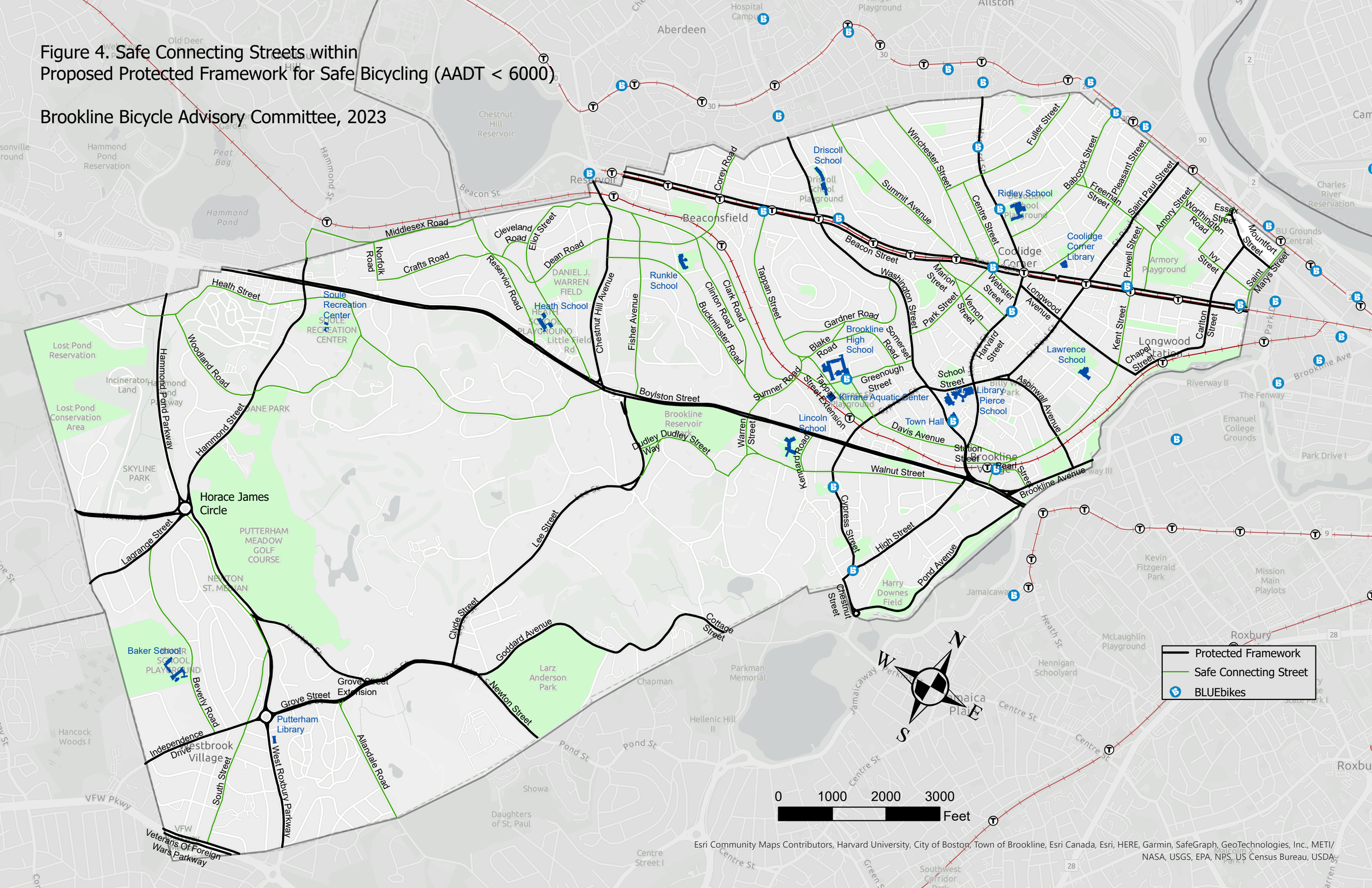
The protected network is complemented by **Safe Connecting Streets**. These streets carry motor traffic volumes of 1,000 to 4,000 AADT with a 3,200 AADT average. All should be made safe for bicycle travel. Several streets with lower traffic volume are included in this list because of their proximity to important destinations, such as Greenough Street near Brookline High School. Possible treatments include protected bike lanes, traffic calming to slow motor traffic to 20 mph, and contraflow lanes. Table 2 lists the proposed Safe Connecting Streets. Figure 4 shows the Safe Connecting Streets and the Protected Framework together. Appendix B identifies specific projects for these streets.

Table 2. Safe Connecting Streets

| | | |
|---|---|---|
| Allandale Road | Essex Street | Reservoir Road |
| Amory Street | Fisher Avenue | Saint Mary's Street |
| Babcock Street | Freeman Street | Somerset Road |
| Beverly Road | Gardner Road | South Street |
| Blake Road | Greenough Street | Station Street |
| Buckminster Road | Heath Street | Summit Avenue |
| Centre Street | Ivy Street | Sumner Road |
| Clark Road | Kennard Road | Tappan Street |
| Cleveland Road | Kent Street | Vernon Street |
| Clinton Road | Marion Street | Walnut Street |
| Corey Road | Middlesex Road | Warren Street |
| Crafts Road | Norfolk Road | Webster Street |
| Davis Avenue | Park Street | Winchester Street |
| Dean Road | Pearl Street | Woodland Road |
| Dudley Street | Pleasant Street | |
| Eliot Street | Powell Street | |

Figure 4. Safe Connecting Streets within
Proposed Protected Framework for Safe Bicycling (AADT < 6000)

Brookline Bicycle Advisory Committee, 2023



# 3. Bicycling in Brookline today

People of all ages and abilities ride bicycles in Brookline year-round, commuting to work and school, shopping, and enjoying the outdoors with friends and family. Since the Green Routes Network Plan was first developed in 2008, various policies and programs have been implemented in Town with the goal of improving bicycling access for all users.

### Complete Streets

Brookline's Complete Streets Policy was adopted by the Select Board in 2016. A Complete Streets Prioritization Plan was subsequently issued in 2018. The policy states that:

> *The Town of Brookline shall plan, construct, and maintain its public ways to enhance safety, access, inclusion, convenience and comfort for all users, thereby creating "complete streets." The Town will create a comprehensive transportation network that sufficiently accommodates people of all ages and abilities, whether traveling by foot, bicycle, wheelchair, mass transit, or motor vehicle.*
>
> *...the Town's transportation projects shall be designed and implemented to provide safe and comfortable access for healthful transportation choices such as walking, bicycling, and mass transit. The needs and safety of the town's most vulnerable users shall be given special consideration during project planning. Users may be considered vulnerable by virtue of their mode of transportation, such as bicycling or walking, or because of their age or mobility.*

### Climate Action Plan

Brookline's 2017 Climate Action Plan recommends prioritizing planning to achieve zero greenhouse gas emissions by 2050 Town-wide. The Climate Action Plan identifies five strategies, including "Improved Transportation Options." Improving bicycle infrastructure provides an opportunity for the Town to work toward its zero emissions goal while also providing residents a safe and healthy way to move around town.

### Sustainable Transportation warrant article

In 2019, Town Meeting Warrant Article 31 established the basis for and actions toward making safer infrastructure for bicycling and other non-vehicular forms of traffic. It requires the Town

> *"...to leverage its pre-existing strengths to prioritize safe, space efficient, and energy efficient movement of people and goods over the movement and parking of private vehicles when designing and improving our public ways, with particular focus on high-traffic routes, connectivity and directness. This should be accomplished in a manner that gives particular consideration to equity of access and safety for (i) people of a broad range of ages, abilities and financial means, and (ii) use of healthful and sustainable transportation modes."*

### Vision Zero

In April 2022, the Select Board created a committee to propose a policy for adoption by the Town and develop a work plan to implement Vision Zero. As noted in the committee's

charge, Vision Zero is *"...an approach to roadway design that seeks to eliminate all traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all. It starts with the ethical belief that everyone has the right to move safely in their communities, and that system designers and policy makers share the responsibility to ensure safe systems for travel."*

Together, these policies demonstrate changing attitudes toward transportation. Bicycle infrastructure that might once have been considered a luxury is now an essential component of transportation planning in Brookline and in many US communities. However, the Town has made limited progress toward establishing a connected route network with low traffic stress that will improve safety and increase bicycle use.

## Existing accommodations

Figure 2 shows the status of bicycle accommodations in Brookline. Appendix B lists projects that have contributed to this progress. In 2016, Brookline received a bronze Bicycle Friendly Community designation from the League of American Bicyclists. The accompanying report card compares Brookline with national metrics and indicates key steps for progress. Boston has attained silver status in the program, while Somerville is one of 40 gold-level communities nationwide.

## Annual bicycle counts

BAC has conducted bicycle traffic counts each September since 2008. Although the 2016 Complete Streets Policy commits the Town to conducting annual bicycle counts, the counts remain strictly a volunteer operation without professional supervision, in marked contrast with the methods used in communities such as Boston and Cambridge. BAC volunteers count bicycles via direct observation on major roads, important commuting routes, and at key intersections.

Counts consistently show over 100 bicycles per hour during commuting times at multiple locations including Beacon Street at Carlton Street, Beacon Street at Short Street, Harvard Street at Fuller Street, and along the Muddy River Path. Over 200 people were observed riding bicycles in a one-hour period on Essex Street and on Longwood Avenue at Chapel Street.

The 2022 bike count took place between September 12 and September 29. Sixteen locations were observed for 90-minute intervals to identify peak hour morning commute traffic. The 1,400 peak-hour riders were about the same as observed in 2012. This represented a substantial increase from the 900 riders observed in 2020, though still below the 2019 high of 1,900 riders. The peak morning 60-minute period for bicycle use began at 8:00 AM. The two afternoon counts were both busiest beginning at 5:00 PM. Parked bicycles were counted at BHS and in Coolidge Corner. The number of bikes parked at BHS and in Coolidge Corner were the lowest or second lowest since counts began other than in 2020.

Women accounted for one-third of riders; this proportion matches findings from a recent study across 11 countries which found that women constituted one-third of riders in New York and Philadelphia. The US findings contrasted with observations in Germany, Netherlands, Finland, and Japan, where women accounted for at least half of all cyclists.

## Bluebikes

Demand for bicycles as a means of transportation is demonstrated by the phenomenal 206% growth in Bluebikes trips originating from Brookline's 14 Bluebikes stations in September 2022 (557 rides per day) compared with September 2018 (182 rides per day) as shown in Figure 5. This exceeds the 154% growth in systemwide usage over that period. Over 105,000 rides originated in town for the year (289 per day), up from 62,000 in 2019 (169 per day). The most frequently used stations in 2022 were Babcock Street (83 trips per day in September), St. Mary's Street (70), Coolidge Corner (68), and Marion Street (62). Townwide usage in 2022 varied from 91 trips per day in February to 557 trips per day in September.

Bluebikes trip timing in Brookline aligned closely with Brookline bike count observations. The peak hour for September trip starts began at 7:45 AM, while the peak hour for returns began at 5:15.

Bluebikes data also demonstrate the increasing proportion of bicycle use occurring outside traditional commuting hours. Whereas 12% of September trips originating in town occurred in the 8 AM hour in 2018 and 2019, the morning peak hour now accounts for only 7% of daily trips. In September 2022, 39% more trips began in the two hours beginning at 5 PM than during peak morning usage from 7 to 9 AM.

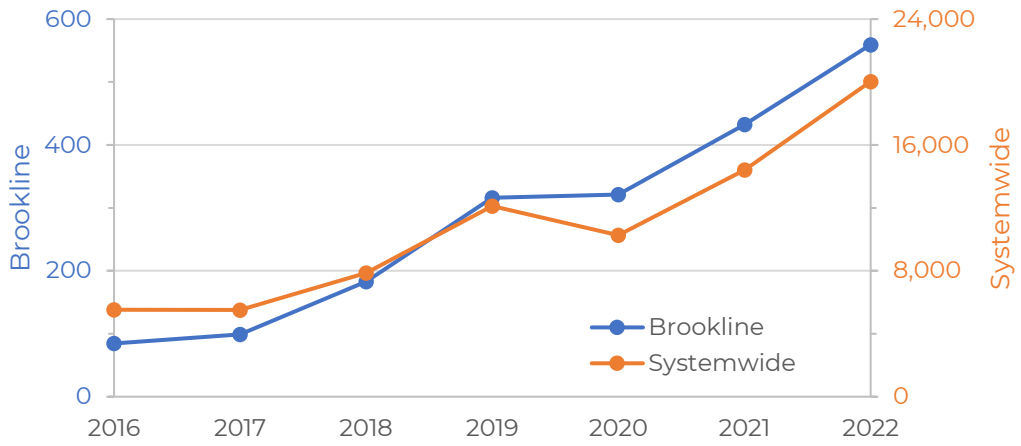



Figure 5. September Bluebikes trip starts

## Progress report

Brookline has made bicycling infrastructure improvements over the past few years. Since the Town's adoption of the Complete Streets policy, bicycle accommodations are

considered in all roadway improvement projects. BAC is invited to provide input to improve bicycle infrastructure in roadway design projects.

While the Town's achievements are commendable, bicycle use remains well below its potential and does not meet the criteria of the Complete Streets Policy. For most residents, getting outside their immediate neighborhood requires negotiating heavily trafficked streets, resulting in a level of stress and danger that many people – especially less experienced bicycle users – prefer to avoid. Many Brookline streets which are suited to bicycling are not connected in a network that facilitates crosstown travel, and are threatened by increased motor vehicle traffic. Even many of the Town's bicycle facilities subject bicycle riders to high traffic stress. Bicycle lanes on Beacon and Harvard Streets disappear at intervals, leaving bikes in heavy traffic, particularly at intersections. Bike lanes often occupy the "door zone" adjacent to high turnover parking lanes and are seldom protected from moving traffic. Double parking and curbside parking by motor vehicles block bike lanes and force bikers to stop abruptly or merge into heavy traffic. A 2017 study of bike lane violations showed that bike lanes on 18 segments of Harvard and Beacon Streets were blocked by motor vehicles 27% of the time. Thus, even recent improvements to bicycle facilities must be viewed as transitional; further improvements are needed to make them truly safe and low stress.

Brookline has failed to advance its bicycle planning strategy at pace with national trends. Since the Green Routes Plan was developed in 2008, US transportation planning norms for bicycle accommodations have evolved. A decade ago, sharrows painted on streets were considered desirable bicycle amenities while dedicated lanes were rare. Today, physical separation of bicycle and heavy motor traffic has become a key component of transportation planning in urban corridors, with unprotected lanes reserved for lightly trafficked routes. NACTO guidance states that sharrows should only be used for short connections between longer bike lane segments. As of 2023, Brookline has less than one mile of protected bike lane.

The list of funded improvements to bicycle infrastructure for 2023 and beyond is modest when compared with improvements being made in Boston, Cambridge, and Somerville. The only major planned and funded permanent improvements to Brookline's bicycle infrastructure are part of road construction projects, including Complete Streets projects. It appears that Brookline will present gaps in a growing connected bicycle network as shown in the Metropolitan Area Planning Council's trail map. We must do better to conform with the "Improved Transportation Options" strategy in Brookline's Climate Action Plan.

Existing bike lanes conditions are deteriorating. Lanes along major parts of Washington Street, Harvard Street, and Pleasant Street suffer from potholes, major cracks, missing paint, and sewer dips, rendering bicycling in those lanes unpleasant and potentially dangerous. In 2020, BAC submitted a memorandum to the Transportation Board listing some of the worst spots and requesting repairs, especially for roads not scheduled for resurfacing within two years. The town's Department of Public Works has subsequently committed to more active maintenance of bicycle facilities.

# 4. Steps to complete the plan

The existing accommodations do not yet form a connected bicycle network. To enable people of all ages and abilities to bike safely and comfortably throughout Brookline and to meet our emissions and Complete Streets goals, bicycle accommodations must be improved, especially on busy streets. Bike lanes need to be widened, buffered, or physically protected to reduce the risk of crashes. As engineering standards for bicycle accommodations evolve, additional improvements should be made to the Town's streets to reflect best practices. Specific recommendations follow.

## Design and implement new accommodations

As bicycle accommodations are planned and implemented, priority should be given to the Protected Framework with the following considerations:

- Intersections are the most dangerous locations for all street users and the locus of many crashes and injuries. Special attention should be given to safe passage through intersections for all users. This may require special traffic signals and/or pavement markings for crosswalks and bicycle crossings.
- All traffic signals should either be on a regular cycle that provides opportunities for all road users to cross in all directions OR sensors should be set so that a bicycle in the road can trigger them.
- Bicycle users should be permitted to cross streets with advance pedestrian walk signs provided doing so does not endanger pedestrians.
- Streetlights should be adequate and appropriately aimed to make the right of way visible to pedestrians and cyclists.
- Avoid changes such as bulbouts that force bikes to temporarily merge with motor traffic.

The impact of bicycle accommodations can often be tested via low-cost pilot projects. Pilot project durations can range from a few days to a year, such as the pilot of parking protected lanes on Beacon Street outbound from Marion Street to Westbourne Terrace. Many can be accomplished with traffic cones, water-soluble paint, or other inexpensive and temporary materials. Pilots can provide valuable information on bicycle safety, impact on pedestrians, and traffic flow impact.

## Fill network gaps

Bicycle lanes that disappear at intersections or have repeated gaps do not offer safe, continuous routes. Major gaps are delineated in the street list and can be seen in Figure 2. There are also gaps that need to be filled to knit together safe, continuous bike routes, including:

- Beacon Street outbound from Pleasant Street to Marion Street and inbound from Webster Street to Saint Mary's Street
- Harvard Street, where bike lanes repeatedly merge into motor vehicle travel lanes
- Netherlands Road crossing between Parkway Road and the Muddy River Path

- Washington Street, where bike lanes turn into shared bicycle/motor vehicle lanes, such as at the intersection with Beacon Street
- The partially completed Fenway Multiuse Path will link the Muddy River path in Brookline to Lansdowne Station near Fenway Park. Project completion requires design coordination with the MBTA.

## Maintain existing accommodations

Bicycle infrastructure must be adequately maintained. Painted lines, stencils, bollards, curbs, and other measures that improve safety for cyclists sharing roads with motor traffic must be promptly replaced when damaged by regular wear and tear or removed for repair or construction projects. Monitoring of utility and other construction work should ensure that trenches or other pavement cuttings do not leave dangerous ridges in bike lanes. Bike lanes should not be obstructed by overhanging vegetation, debris and snow. Road surface conditions along heavily used streets that lack protected bicycle lanes are of particular concern. Examples include Harvard Street and Chestnut Hill Avenue. The bike lanes along these streets are characterized by large cracks, potholes, sewer dips, and other hazards. This is unpleasant at best and life-threatening at worst. In some situations, bikers are forced out of the bicycle lane into traffic in order to avoid major hazards.

Historically, bike lane repair has been coincident with scheduled repair of the road. However, the situation has become increasingly dangerous on critical roads, and scheduled road repairs might be years away. Bike lane condition should be assessed to prioritize needs. An inventory of bicycle accommodations could identify streets in most urgent need of repair. If a bike lane is in poor condition and the schedule for that street's repair/resurfacing is two or more years away, a temporary repair of that bicycle lane should be undertaken, such as aggressive patching, or temporary resurfacing of the bike lane.

A specific budget and priority list should be established each year for bicycle lane repair and maintenance of existing street markings designed for safety, including bicycle and pedestrian markings like the program for sidewalk repairs in accordance with the goals identified in Warrant Article 31 passed in 2019. Repair of dangerous pavement should also be undertaken.

BrookONline, a website and phone app for reporting problems that need to be addressed by Town Departments could be utilized to identify sites in need of repair. New categories directly related to bicycle issues should be added, such as reporting for bicycle lane obstruction and bicycle lane repair.

## Install wayfinding signage


Bicycle wayfinding signage provides information on distances and directions to key locations and the best routes to those destinations. Destination signs also advertise the Town's bike routes, tourist sites, and commercial areas, and promote bicycling. Wayfinding increases awareness for automobile drivers. When they see a bicycle wayfinding sign, it indicates that a route is a cycling corridor. Appendix A presents examples of wayfinding signage and pavement markings.

We recommend three signage guidelines as part of the Green Routes plan:

- Improved signage and wayfinding to destinations in Brookline elsewhere such as Coolidge Corner, downtown Boston, Longwood Medical Area, and the Charles River
- Wayfinding should direct travel via bicycle facilities and along signed routes
- Signs should be legible for both bikes and motor traffic

## Create Green Routes to schools

Students should be able to approach schools from every direction via safe sidewalks and protected, separated bike lanes. Special consideration should be given to separating motor vehicle pick-up and drop-off areas from walking and bicycle routes in coordination with the Massachusetts Safe Routes to School program. School renovation plans can include sidewalk improvements, bicycle accommodations and safe pick-up and drop-off areas to enhance the ability of students to walk or bike safely to schools.

The recommendations presented below have been contributed by community members familiar with the neighborhoods around each school and the Town's Safe Routes to School task force. They vary in scope and detail. They include recommendations for sidewalks which are used by children bicycling to school. Any discussion of bicycle accommodations concerning schools should involve the community in the design process.

### Baker School

The streets in the envisioned Green Routes Network Plan that provide access to and from the school, including Beverly Road, Grove Street, Independence Drive, Lagrange Street, Newton Street, South Street, and West Roxbury Parkway should be high priority for improved bicycle infrastructure and maintenance. Baker School has a large and widely distributed population. The results of a 2019 MassDOT Safe Routes To School household survey show a large number of households where currently students typically travel to school by car. Many of these households are at distances of 0.5 mile or more from school; distances that are eminently bikeable, particularly for middle schoolers. Suggested improvements include:

- Beverly Road provides the main access to the school. Children bicycling often use the sidewalk given the large number of fast-moving cars. This leads to conflicts with pedestrians. Bike lanes are necessary. Minimally one lane is required from Independence Drive to the school, against the flow of cars during morning arrival. Positioning this bike lane towards the center of the road and allowing space for parked cars would also discourage drivers leaving the school from treating the road as two lanes, trying to overtake slower cars. Ideally a bicycle lane would extend to Lagrange Street.

  A traffic calming plan for Beverly Road that includes no parking zones, raised crosswalks and restricts traffic turning from Independence Drive during school hours, was approved in 2022.

- Russett Road serves as a collector for the many students who already bike from the neighborhood on the south side of Independence Drive as it leads to a supervised crossing of Independence Drive. The street should be traffic-calmed to 20 mph so that bicycles can safely mix with motor traffic.

- Puddingstone Road is one-way from West Roxbury Parkway to South Street. It provides a route from the Putterham Library crosswalk across the Parkway towards Baker School that avoids the Putterham rotary. Contraflow bicycle travel would allow safe use of the road in the opposite direction.

- West Roxbury Parkway separates a large cluster of households from Baker at distances of approximately a mile from school. It should have protected bicycle lanes in both directions. The crosswalks at Putterham Library and Putterham Circle should be modified to increase safety.

### Driscoll School

Driscoll School is currently undergoing major reconstruction anticipated to be completed by September 2023. The roadway plan being implemented includes bicycle lanes on Westbourne Terrace from Beacon Street to Bartlett Street, on Bartlett Street from Westbourne Terrace to Washington Street, Bartlett Crescent from Bartlett Street to the school, and continuation of the Beacon Street westbound bicycle lane from Summit Path to Westbourne Terrace. The additional recommendations below were suggested by BAC during development of the Driscoll School plan.

- Beacon Steet and Washington Streets are parts of the envisioned Protected Framework and provide access to and from the school. These should be high priority for improved bicycle infrastructure and maintenance. Bartlett Street, Bartlett Crescent, and Salisbury Road are quiet streets leading to Driscoll that can serve as important safe routes for students on bikes.

- Westbourne Terrace should have a protected two-way cycle track adjacent to the

sidewalk on the west side between Beacon Street and the school that would lead directly to the playground and rear entrance. The short flight of stairs should be improved with a bicycle channel or ramp. Bicycle parking on the Westbourne Terrace side of the school should be maintained and expanded.

- Westbourne Terrace from the north is a narrow, quiet street used by students commuting from Corey Hill. From the intersection of Westbourne Terrace and Bartlett Street, students should be able to either continue straight onto a raised separated two-way cycle track adjacent to the school to the Westbourne Terrace entrance, or turn right onto a raised cycle track along the south side of Bartlett Street and then turn left into the parking lot/rear entrance bike parking area.

- Washington Street from the south has a bike lane outside of metered parking. This should be replaced by a raised cycle track adjacent to the sidewalk, to allow students to either turn into a multi-use path adjacent to the playground, or into the parking lot.

- Washington Street from the north currently has sharrows. Students can approach the protected crosswalk with crossing guard at Salisbury Road and Washington Street and enter into either lower parking lot or walk their bikes along the walkway adjacent to the playground to reach bike parking.

- Bartlett Street should have a raised contraflow lane.

### Heath School

The streets in the envisioned Green Routes Network Plan that provide access to and from the school, including Chestnut Hill Avenue, Eliot Street, Reservoir Road, and Boylston Street should be high priority for improved bicycle infrastructure and maintenance.

- There should be a continuous sidewalk along one side of Heath Street from Hammond Street to Lee Street so users do not have to cross repeatedly, as is the case now. The segment between the Warren Street and Reservoir Road is particularly difficult.

- Improve the crosswalk at the intersection of Chestnut Hill Avenue and Clinton Road by moving the crosswalk and adding flashing yellow warning lights or a pedestrian activated traffic signal.

### Lawrence School

The streets in the envisioned Green Routes Network Plan that provide access to and from the school, including Aspinwall, Kent, Longwood, and Saint Paul Street should be high priority for improved bicycle infrastructure and maintenance.

### Lincoln School

Lincoln School serves neighborhoods both north and south of Boylston Street. Students

cycling to Lincoln school from areas south of Boylston Street must use Chestnut, Cypress, and Walnut streets. There are no protected bicycle accommodations on these routes, nor are there are safe cycling routes across Boylston Street. The streets in the Green Routes Network that provide access to and from the school, including Boylston Street, Chestnut Street, Cypress Street, and Walnut Street, should be high priority for improved bicycle infrastructure and maintenance.

- Kennard Road is narrow. It lies east of the school. On school days, parked cars occupy much of the northbound lane from Walnut Street to Boylston Street. There is no shoulder and limited room for bicycles. The Town should consider limiting parking or making Kennard Road one-way and adding a two-way protected bike lane.

- Many students travel to school via Walnut Street. Walnut Street borders Lincoln to the south and provides important access to the school directly through the opening in the brick wall at the ball field across from Walnut Cemetery, and as the main connection to Kennard Road. The street is 24 feet wide with medium traffic volume (3,731 AADT). Traffic consistently backs up to the Town Green to the west and Cypress Street to the east during morning arrivals. It should be traffic-calmed to 20 mph so that bikes can safely mix with motor traffic. The Town should conduct a feasibility study for one-way travel.

- A cycle track has been recommended by the Boylston Street Corridor Study Committee along Boylston Street between Cypress Street and Washington Street. Ideally this cycle track would extend to Warren Street to accommodate safe cycling access to Lincoln School on Kennard Road and Maimonides School on Clark Road. A safe crossing zone at the intersection of Boylston Street, Kennard Road, and Clark Road would provide bicycle and pedestrian access to both schools and enable children to avoid cycling on the more heavily trafficked Warren and Cypress Streets.

- Hedge Road provides access to the back entrance of Lincoln School. While it is not widely used as a route to school, this road could better serve bicycles if there were a cycle track on Boylston Street between Warren Street and Cypress Street.

- Chestnut Street is a wide street that allows parking on both sides between Kendall Street and the Paul Pender Rotary at Pond Avenue, and on the northbound side only between Kendall and Walnut Streets. A two-way separated cycle track between Walnut and Kendall Streets has been approved for Safe Routes to School funding with 2025 construction. With reconfigured parking, bicycle accommodations could be extended along the entire length of Chestnut Street.

- Cypress Street has heavy traffic (10,043 AADT) with bike lanes that force cyclists to ride between fast-moving traffic and parked cars in an active commercial zone. It lacks a bike lane approaching Boylston Street from the south. From north of Boylston, there is no safe way for bicycle users to cross Boylston Street because of the right-turn-only travel lane. Bike lanes south of Boylston Street should be

protected, and a dedicated bike light installed at the intersection of Walnut and Cypress Streets that allows bikes to turn before cars begin moving. The feasibility of a protected lane in one direction, or development of an alternate protected signed route should be studied. Possible alternative routes include: a renovated Davis Path footbridge to the proposed cycle track on Boylston Street, or Brington Road to Boylston Street with a crossing from Clark Road to Kennard Road.

- Warren Street is narrow and winding with no shoulder. This road is currently the only route for students cycling from the southwest or northwest. The intersection with Walnut Street at the Town Green is particularly challenging. At the intersection, Walnut Street should be made one-way westbound north of the Green and one-way eastbound south of the Green. Accommodations should be made for safe two-way bicycle travel on the section between Walnut Street and Boylston Street. Warren Street should be traffic calmed to 20 mph from Boylston Street to the eastern end of Dudley Street.

### Pierce School

The streets in the envisioned Green Routes Network Plan that provide access to and from the school, including Aspinwall Avenue, Davis Avenue, Greenough Street, Harvard Street, Marion Street, Park Street, Saint Paul, School and Washington Streets should be high priority for improved bicycle infrastructure and maintenance. Due to its location, surrounded by high-volume streets, and lack of alternative through streets, it is not currently possible for most students to cycle safely and independently to school.

- Bicycle lanes on portions of Cypress Street., Washington Street., Harvard Street and Saint Paul Street are often sandwiched between parked cars and fast-moving traffic making them unsuitable for children.

- Harvard Street has intermittent bicycle lanes placed between parked cars and fast-moving traffic. Vehicles standing in the bike lane necessitate frequent detours into car traffic. Physically separated bicycle lanes are essential to student safety along this street.

- Washington Street is wide with limited bicycle infrastructure consisting mainly of sharrows and intermittent bicycle lanes. These treatments are inadequate due to high traffic volume and speed. The Washington/Cypress/School Street intersection is particularly dangerous having no designated route for bicycles to move through the intersection resulting in a high incidence of bicycle crashes. The presence of right-turn slip lanes on either side of the intersection makes it challenging for students who may wish to bicycle on the sidewalk to avoid the dangerous intersection. These slip lanes should be removed and separated bicycle lanes constructed to facilitated safe passage across the intersection. Several streets intersecting with Washington Street (for example Weybridge Street) have wide crossings which facilitate high speed motor vehicle turns which put students riding

on the right-hand side or on sidewalks at risk. These crossings should be narrowed to reduce the chance of high-speed vehicle turns.

- School Street. A group of parents recently proposed closing School Street to through traffic during school hours. In addition to the many safety benefits to students crossing to their recreation area at Pierce Playground, this would drastically improve safety for students bicycling on School Street. which currently has no bicycle infrastructure. Closing School Street would have a profound impact on abutting portions of several streets that would no longer be attractive cut-through streets for motor vehicles, specifically Cypress and Saint Paul. Slow speeds would need to be maintained on other possible cut-through routes between Washington and Harvard Street were this plan implemented.

- Saint Paul Street has parking on the western side and a painted curbside bike lane on the eastern side between Longwood Avenue and Aspinwall Avenue. High motor vehicle speeds make riding in the roadway hazardous for students especially on the western side where parked cars narrow the roadway. Of special concern is the intersection of Saint Paul Street, School Street, and Aspinwall Avenue. Vehicles traveling south on Saint Paul approaching the intersection speed up on the downhill and jockey to fan-out into multiple lanes. A painted bicycle box on Aspinwall Avenue approaching the intersection from the west, moves bicycles into a dangerous position to turn left from the right lane. This intersection should be reconfigured to bring vehicles to a halt where turning lanes come into conflict and provided with physically separated cycling infrastructure.

- Aspinwall Avenue should have protected bike lanes in both directions.

- The portion of Cypress Street between Tappan and Washington Streets has a painted bicycle lane on the eastern side and sharrows on the western side. Motor vehicle speeds are high on this street despite its narrow width. The street is too narrow to provide two opposing traffic lanes and separated bicycle infrastructure. The sidewalks are also narrow. The Town should explore significant changes to Cypress Street between BHS and the town center to lower motor vehicle speeds to levels where bicycles may safely share the roadway or reconfigure lane directions to provide adequate space for separate bicycle infrastructure.

### Ridley School

The streets in the envisioned Green Routes Network Plan that provide access to and from the school, including Babcock, Beacon, Freeman, Harvard, Pleasant and Saint Paul Streets should be high priority for improved bicycle infrastructure and maintenance.

- Babcock Street needs protected bike lanes. Babcock leads into the playground, where there are bicycle racks which are well used. More bicycle parking could be added.

- The intersection of Babcock Street at Freeman Street should be made safer for bicycles.

- Pleasant Street is a major route to the school from neighboring streets and Brookline Housing Authority apartments on Egmont Street, Pleasant Street and Saint Paul Street. With its medium traffic volume (3,543 AADT) and narrow width, Pleasant Street should be traffic-calmed to 20 mph so that cyclists can safely mix with motor traffic.

- Bicycles lanes on Harvard should be protected and continuous. During the morning commute, the bike lane north of Beacon Street is often blocked by delivery vehicles and cars.

- Several streets in the JFK Crossing neighborhood, including Abbottsford Road, Beals Street, Coolidge Street, Kenwood Street, Russell Street, Thorndike Street, and Verndale Street have portions that were at some point made one-way, presumably to discourage cut-through traffic. All these streets are wide enough to allow contraflow travel that would allow for easier and more direct bicycle navigation.

### Runkle School

The streets in the envisioned Green Routes Network Plan that provide access to and from the school, including Beacon Street, Buckminster Road, Clark Road, Clinton Road, Dean Road, Fisher Avenue and Tappan Street should be high priority for improved bicycle infrastructure and maintenance. Runkle School has a budding biking culture that would be vastly improved with much needed safety measures to promote increased biking and walking.

- The intersection of Dean Road and Clinton Road could be improved with a raised intersection, which would greatly slow the turning speed of cars and increase the visibility of walkers and bikers.

- Dean Road has medium traffic volume (3,630 AADT) with very limited bicycle accommodations. Protected bicycle lanes are recommended. The intersection of Dean Road and Beaconsfield could be improved with a raised intersection or crosswalk, improved intersection geometry and corner radius design to decrease turning speed or by daylighting the intersection to make everyone on the street easier to see.

- The intersection of Tappan Street and Garrison Road should have a raised intersection to protect cyclists and pedestrians.

- The heavily trafficked area of Regent Circle and the Star Market Parking presents a serious challenge to bicycle users seeking to turn left from the parking lot onto Regent Circle. This area would benefit from a flashing crosswalk beacon, yield lines, or speed hump markings to increase the visibility of bicycles and heighten the

alertness of drivers traveling on Regent Circle to Beacon Street.

### Brookline High School

BHS facilities serve the entire town. It is used by people attending school and community events, as well as users of the Evelyn Kirrane Aquatics Center, nearby playgrounds, and athletic fields. BHS students travel from all parts of town; all the accommodations proposed in the Green Routes Network Plan would benefit its students. The streets nearest BHS in the Green Routes Network Plan are Cypress Street, Davis Avenue, Greenough Street, Harvard Street, Park Street, Tappan Street, and Washington Street. These should be high priority for improvement and maintenance.

Improved bicycle accommodations at BHS are scheduled to be installed in 2023. These include:

- Buffered contraflow bicycle lane on Davis Avenue between Greenough Street and Cypress Street.
- Buffered contraflow bicycle lane on Tappan Street between Greenough Street and Cypress Street
- Buffered contraflow bicycle lane on Greenough Street in front of BHS.
- Raised intersections at Tappan, Greenough, and Sumner Streets.

Additional accommodations in the immediate vicinity of BHS could include extension of the protected contraflow lane on Tappan from Greenough Street to Blake Road and protected contraflow lanes on Sumner Street from Greenough Street to Blake Road.

Students traveling from South Brookline have limited commuting options without use of private motor vehicles. The school bus route has limited runs, restricted timing, and a $400 annual cost, all of which disincentivize its use. Public transportation routes are indirect, time-consuming and infrequent. Existing bicycle lanes are unprotected on high-speed, heavily trafficked roads. The following additional accommodations would benefit students traveling to BHS from South Brookline.

- The principal route from South Brookline to BHS follows Independence Drive, Grove Street, Newton Street, Clyde Street, and Lee Street. All these roads are part of the Protected Framework and should have protected bicycle lanes. Newton Street between Grove Street and Clyde Street and The full length of Grove Street presently lack bicycle lanes and have little or no shoulder. Safety should be improved at Putterham Circle. The rotary could be reduced to a single travel lane or replaced with a traditional intersection to improve pedestrian and bicycle safety. The intersection at Newton Street and Clyde Street should be engineered to allow safe bike passage.

- Improved bicycle accommodations on Lee Street and Clyde Street between Boylston Street and Newton Street should be prioritized. In the short-term, enforcement to prevent parking in the existing bike lanes is needed. The oddly shaped rotary formed by the intersection of Lee, Dudley, and Warren Streets is dangerous, particularly for bicycle users continuing on Lee when cars turn right onto Warren. Turning left from Warren St onto Lee Street is also difficult. This rotary should be adapted to allow safely bicycle travel. An ideal solution would be a greenway including a two-way protected bicycle lane in the center of Lee Street and Clyde Street continuing through the rotary.

- Warren Street is narrow and winding with no shoulder. The intersection with Walnut Street at the Town Green is particularly challenging. At the intersection, Walnut Street should be made one-way westbound north of the Green and one-way eastbound south of the Green. Accommodations should be made for safe two-way bicycle travel on the section between Walnut Street and Boylston Street. Warren Street should be traffic calmed to 20 mph from Boylston Street to the eastern end of Dudley Street.

- Sumner Road bicycle accommodations should be prioritized, particularly the recommendations for engineering safe crossing at Boylston Street.

- Dudley Street and Walnut Street complete the route from South Brookline to BHS. Recommendations for Dudley Street should be prioritized.

- Bicycle use should be allowed on the Brookline Reservoir pathways with bicycles required to yield to pedestrians. This would provide an alternative to both Dudley Street and the segment of Warren Street between Walnut Street and Boylston Street.

# 5. References and useful documents

The Engineering and Transportation Division of the Department of Public Works has information on bicycling and other transportation issues: www.brooklinema.gov/140

The Biking Brookline advocacy group has compiled Town documents and other bicycling resources: www.bikingbrookline.org/town-documents

Brookline Complete Streets Policy (2016).
www.brooklinema.gov/DocumentCenter/View/10212

Brookline Complete Streets Prioritization Plan (2018). Prepared by Howard Stein Hudson.
www.brooklinema.gov/DocumentCenter/View/17785

Cambridge Bicycle Plan 2020.
www.cambridgema.gov/Departments/communitydevelopment/2020bikeplanupdate

Federal Highway Administration (2012). *Manual on Uniform Traffic Control Devices*.
mutcd.fhwa.dot.gov

MassDOT *Bicycle and Pedestrian Infrastructure Assessments, Brookline, MA, Harvard Street Corridor: Longwood Avenue to Shailer Street (*2016). walkboston.org/wp-content/uploads/2016/08/WalkBoston-HarvardStreetWalkAssessment-Brookline.pdf

MassDOT *Municipal Resource Guide for Bikeability* (2019). www.mass.gov/doc/2019-municipal-resource-guide-for-walkability

MassDOT *Separated Bike Lane Planning Design Guide* (2015).
www.mass.gov/lists/separated-bike-lane-planning-design-guide

MassDOT Engineering Directive E-20-001 “Controlling Criteria and Design Justification Process for MassDOT Highway Division Projects” (2020).
http://www.mass.gov/doc/controlling-criteria-and-design-justification-process-for-massdot-highway-division-projects-e

National Association of City Transportation Officials, *NACTO Urban Bikeway Design Guide* (2014). nacto.org/publication/urban-bikeway-design-guide

National Association of City Transportation Officials, Urban Street Design Guide
nacto.org/publication/urban-street-design-guide

# Appendix A: Roadway treatments and other bicycle accommodations

A variety of bicycle roadway treatments, bicycle accommodations, wayfinding signs and pavement markings are available to create a bicycle-friendly network. Details can be found in the NACTO Urban Bikeway Design Guide, Massachusetts Separated Bike Lane Planning Guide, Cambridge Bicycle Plan 2020, and elsewhere. Examples are show below.

## Roadway treatments

***Bicycle lanes*** are located adjacent to motor vehicle travel lanes and delineated by pavement markings and signage. Bicycle traffic flows in the same direction as motor vehicle traffic. Bicycle lanes are typically on the right side of the street. Lanes are appropriate on moderate speed streets with low traffic volumes, low turnover parking lanes, and few intersections with heavy right-turning traffic. Where parallel parking is present, bike lanes must be wide enough and adequately engineered to discourage cyclists from riding in the "door zone," where opening car doors can endanger bicycle users. Bike lanes that terminate abruptly, for example to make space for a turning lane, make roads dangerous.

***Bicycle priority lanes*** are shared travel lanes (bike and motor vehicle) indicated by "Bikes may use full lane" signs and/or roadway markings such as sharrows. These lanes are not recommended, nor are they considered adequate to satisfy the *Complete Streets Policy* without the granting of an exception, because if traffic speeds or volumes are great enough to require special signage or road markings, then they are great enough to require bike lanes. Nevertheless, in Brookline, sharrows are in use on Longwood Avenue and Washington Street, for example. Markings that delineate a bicycle priority zone allow bikes to travel more confidently on street segments where a full bike lane is not feasible.

***Buffered bicycle lanes*** are designated exclusively for bicycles, separated from the adjacent motor vehicle travel lane and/or parking lane by a buffer lane of some width—usually designated by striped painted lines in the buffer area. Buffers increase bicycle safety by designating an area adjacent to a bike lane to highlight a safe door opening area and/or motor vehicle passing distance.

***Bus-bike lanes*** dedicate standard width traffic lanes to exclusive use by public buses and cyclists, enabling buses to proceed with less delay while protecting bicycle users from cars and trucks.

***Contraflow*** allows two-way bicycle traffic on streets designated as one-way for motor traffic. "One Way" and "Do Not Enter" signs on such streets require a supplementary plaque on "Do Not Enter" signs: "Except Bicycles." One-way restrictions are often applied in Brookline to keep through traffic off residential streets, making those streets ideal for

contraflow bicycling. In many situations, contraflow offers bikes safer and more direct routes. Formally designating one-way streets two-way for bicycles using signs and markings can improve safety through raising motor vehicle drivers' expectations of encountering oncoming bicycle traffic. Contraflow lanes were first installed on Netherlands and Parkway Roads in 2009 and have since been implemented across town.

***Cycle tracks and separated bike lanes*** are parallel to a road but are physically protected from motor traffic lanes by a curb or other physical barriers, such as parked cars or delineator posts. Some are raised to the level of the adjacent sidewalk. Increasingly, they are considered necessary to make the busiest streets safe and low stress for bicycling.

***Detours during construction:*** At construction sites that block normal sidewalks and bicycle paths, safe accommodations for pedestrians and bikes should be provided.

***Intersections*** are the most dangerous locations for all road users and the sites of many crashes. For bicycle safety, it is important to continue bike lanes through intersections and sometimes paint them green to alert motor vehicle drivers, especially those making turns, of the presence of bicycles. Bike boxes can also be useful at signalized intersections. (see References for NACTO recommendations on intersections.)

***No passing bicycles zones*** are appropriate on short sections of streets that are too narrow for a car to pass a bike without crossing the center line, and where crossing the center line is dangerous because of frequent intersections or limited sight distance. One example is Carlton Street southbound from Beacon Street, where motor vehicle drivers frequently squeeze past bicycles with little clearance, and often drive on the wrong side of the road as they approach the sharp turn onto Colchester Street. Another example is on curved sections of Heath Street. A posted passing restriction encourages bikers to ride at a safe distance from the curb, making the restriction self-enforcing, and relieving motor vehicle drivers of the stress of seeking an opportunity to pass when it isn't safe to do so.

***End-marked bike contraflow:*** One-way streets can offer bicycle users connections or routes that avoid streets and intersections with heavy traffic. End-marked contraflow permits bicycles to travel against motor traffic on low volume one-way streets without a painted lane. Signs are used at the beginning and end of the street: on the "No entry" end, an additional sign is added— "except bicycles." On the other end, signage informs drivers to "Expect two-way bicycle traffic." This treatment has been implemented in Somerville, but is otherwise rare in the US. It is common practice in Europe.

***Road diets (pavement reductions)*** reduce the number of lanes on a road, usually to one in each direction, plus short extra lanes where needed for capacity at intersections. Candidates include Lee Street, Clyde Street, Hammond Street, Newton Street, and West Roxbury Parkway bordering the Putterham Golf Course. The reclaimed space can be used

to create greenways with tree lawns and shared use paths, benefitting both pedestrians and cyclists.

***Shared use paths*** permit more than one type of user. Ideally, roadside bike paths are distinct from the sidewalk. However, in a park or greenway, a bike path can also be shared with walkers, runners, scooters, and inline skating.

***20 mph Safety Zones*** are a MassDOT designation intended for locations adjacent to where vulnerable road users are likely to be present, such as playgrounds, senior citizen housing, hospitals, high schools, and daycare centers. They should be at least one-quarter mile long and contain areas of potential conflict with motor vehicles.

### Other accommodations

***Bicycle signals***. Bicycle users have unique needs at signalized intersections. Bicycle movements may be controlled by the same signals that control motor vehicle movement, by pedestrian signals, or by bicycle-specific traffic signals. Bicycle-specific signals have been installed on Washington Street in Brookline Village, as well as at various locations in Boston and Cambridge. The MassDOT Separated Bike Lane Planning & Design Guide includes a chapter on bicycle signal design.

***Bicycle parking*** facilitates convenient use of bicycles for transportation, and ensures parked bikes do not impede pedestrians. Single and multiple use racks have been installed in many locations around Brookline, but additional bike parking is needed. Parking meters, as well as "hitching posts" installed on parking meters, are useful for bicycle parking. Town residents have noted a need for additional bike parking at such locations as Town Hall, the Public Safety Building, the small commercial area at Washington and School/Cypress Streets, at schools and parks, and in some residential areas where there are no parking meters and few sign posts available to secure bicycles. Seasonal bike corrals are successfully installed each year in Coolidge Corner and on Washington Street at Station Street.

***Bicycle channels at stairways***: Brookline has several stairways that connect one street to another through the center of blocks. It is recommended to have channels next to the stairs for bicycle wheels, so that a rider could push a bike up or down a stairway to avoid a long ride around or having to carry their bicycle up the stairs. This is particularly important on the stairs between the C Line trolley tracks and the outbound section of Beacon Street at the Brandon Hall and Fairbanks T stops.

***Automatic bicycle counters*** have been installed in many cities. They provide a useful source both of bicycling data and serve as points of interest and encouragement for cycling. One at Staniford Street and Causeway Street in Boston is pictured here.

## Signage and pavement markings


**Wayfinding signage** for bicycling provides information on distances and directions to key locations and the best routes to those destinations. Destination signs also advertise the Town's bike routes, tourist sites, and commercial areas, and promote bicycling.

**Shared lane markings ("sharrows")** indicate where bicycle users should occupy a travel lane to be safe from opening doors on parked cars or other hazards. Motor vehicle drivers drive as normal in a shared lane when no bicycles are present; when bicycles are present, motor vehicle drivers should slow down and pass with care, at a safe distance, and only when it can be done without endangering the cyclist or oncoming traffic. Sharrows do not satisfy the *Complete Streets Policy* without the granting of an exception. Current NACTO guidance only indicates their use for short connections between longer bike lane segments.

**Except Bikes** signs indicate that bicycles are permitted to make maneuvers or enter areas not permitted for motor traffic, such as traveling both ways on a street restricted to one-way motor traffic.



**Change Lanes to Pass**
This sign reminds motor vehicle drivers to pass bicycles at a safe distance by changing lanes.


**Bikes May Use Full Lane** signs provide explicit instructions and communicate more clearly than "Share the Road" signs.

**Walk Your Bike**
"Walk your bike" signs have been installed in Brookline's commercial areas to remind bicycle users to walk their bikes on sidewalks in business districts.


**Colored pavement markings**
Green painted "carpets" in bike lanes, bike boxes and at intersections alert motor vehicle drivers to the presence of bike routes and bike users of the safest areas for riding.

**Bike boxes** are designated areas at the head of a traffic lane at a signalized intersection. Bike boxes ensure bicycle riders are visible to queuing motor traffic when a traffic light is red. By setting the motor vehicle stop line back from the intersection a bike box can also improve pedestrian comfort and visibility.

**Left (two-stage) turn queue boxes** offer bicycles a safe way to make left turns at multi-lane signalized intersections from a right-side cycle track or bike lane, or right turns from a left-side cycle track or bike lane. Left turn queue boxes can also be used at unsignalized intersections to simplify turns from bicycle lanes or cycle tracks. At a midblock crossing, a left turn queue box may be used to orient cyclists properly for safe crossings.

# Appendix B: Street inventory of proposed and existing accommodations

Bicycle users are entitled to use all streets in Brookline. Whenever changes or improvements in roads are planned, consideration should be given to bicycle and pedestrian safety in accordance with the Complete Streets Policy.

Streets are listed below alphabetically by street name. This list includes all streets designated as the Protected Framework (**PF**) and Safe Connecting Streets (**SC**) along with other roadways that are key to completing the Green Routes network. "**HI**" denotes projects and intersections that are highly important and/or dangerous as currently configured. These should be prioritized for reconfiguration, repair, or other appropriate attention. Where traffic volumes and speed are low, bicycles can share space with motor traffic; where traffic volumes are higher, cyclists should be offered accommodations such as those described below. As conditions change and engineering practices advance, additional improvements may be appropriate. For example, some painted bicycle lanes have been upgraded to cycle tracks or protected lanes.

Projects that receive state or federal funding must comply with the "Controlling Criteria and Design Justification Process for MassDOT Highway Division Projects" published in 2020. That document identifies specific criteria and a thorough design process for implementing bicycle and pedestrian accommodations. Some projects identified here are described further in the inventory of "Safety Improvement Projects in Brookline" prepared by DPW in 2021.

**Abbottsford Road**, Beals Street, Coolidge Street, Kenwood Street, Russell Street, Thorndike Street, and Verndale Street in the JFK Crossing neighborhood all have portions that were at some point made one-way, presumably to discourage cut-through traffic. All these streets are wide enough to allow contraflow travel that would allow for easier and more direct bicycle navigation. Alternatively, individual streets could be reconsidered for two-way traffic for all users.

**Allandale Road (SC)** provides an important connection to Allandale Farm, the Arnold Arboretum, and other Boston locations.

The Transportation Board approved buffered bike lanes in each direction as part of the pavement preservation project. *Construction scheduled for Spring 2023.*

**Alton Place between Harvard Street and Saint Paul Street:** Allow contraflow bicycle travel.

**Amory Street (SC)** has medium traffic volume (3,514 AADT). Motor traffic should be calmed to 20 mph.

**Aspinwall Avenue (PF)** provides important connections between Harvard Street and Saint Paul Street to the north and Brookline Avenue to the east. It has a high level of traffic (10,043 AADT), so protected bike lanes in both directions are necessary.

Bike lanes and sharrows painted from Harvard to Saint Paul. *2014*.

**Atherton Road (HI):** Allow contraflow travel from Winchester Street to Summit Avenue to provide a quiet, safe route to the buffered bike lane on Beacon Street (just beyond Summit), allowing cyclists to avoid the heavy traffic of Coolidge Corner.

**Babcock Street (SC)**: Because of its medium traffic volume (3,555 AADT), Babcock Street should be made fully bicycle and pedestrian friendly for its entire length by providing protected bike lanes in both directions. Babcock Street's importance as a connector for bicycles will only grow in the future because it will provide a direct route between Brookline and Commonwealth Avenue, the projected MBTA West Station, and newly created parkland and bicycle paths along the Charles River as part of the I-90 Allston/West Station project.

Bicycle lanes painted on street southbound from Commonwealth Avenue to Harvard Street with painted buffer and green lane and bike boxes to facilitate turns at Harvard Street; sharrows in northbound direction. Pedestrian improvements including crosswalks at all intersections and bulbouts at some intersections. *2019*.

**Bartlett Street and Bartlett Crescent:** Allow contraflow from Washington Street to Westbourne Terrace on south side of street, closest to school to improve access to Driscoll School.

Bike lane on Bartlett Street between Westbourne Terrace and Washington Street, and on Bartlett Crescent from Bartlett Street to Driscoll School. *Planned as part of Driscoll School renovation, 2023.*

**Beacon Street Bridleway (PF):** Restoration of the Olmsted-designed bridle path in the center of Beacon Street along the C line tracks has been proposed as a two-way protected multimodal path with crossovers at major intersections. This proposal would significantly enhance the safety of a major route through Brookline and would connect to bicycle accommodations in the regional network at Boston and Newton. Plans are being developed to accomplish this without much, if any, loss of parking or travel lanes.

Toole Design Group awarded contract for Beacon Street Bridle Path restoration feasibility and concept design study *2021*.

**Beacon Street (PF)** is Brookline's principal east-west bicycle route. Marked bicycle lanes exist on segments of the road, but are not continuous along its entire length. This creates a hazard and causes uncertainty among cyclists and motor vehicle drivers

on how to share the road. Bike priority lanes would provide a minimal connection of the bike lane segments.

A traffic signal for left/U-turn from Beacon Street inbound to Beacon Street outbound or from Charles Street to turn left on Beacon should be triggered by a bicycle.

A traffic signal for left turn from Beacon onto Marion should be triggered by a bicycle.

Design safe passage for bicycles from where the bike lane ends at Pleasant Street to where it resumes at Marion Street.

Improve transition from the end of the westbound bike lane near Westbourne Terrace to Washington Street. Increasingly important due to renovation of Driscoll School.

A morning commute eastbound bike lane would implement parking restrictions on sections of Beacon Street where parking is allowed and there is no bike lane. Time-limited restrictions during the morning commute would effectively create a seven-foot-wide bike lane to the right of the two lanes of motor vehicle traffic, increasing safety and throughput for bicycles and motor vehicles.

Bollards and water-filled jersey barriers installed to discourage vehicles from blocking the separated bike lane. 2022

A 700-foot-long parking-protected bike lane was installed along the north side of Beacon Street from Saint Mary's Street to Carlton Street. *2021*

A buffered bike lane westbound from Marion Street to Westbourne Terrace was installed in 2019.

The eastbound bike lane was extended from Park Street to Webster Street along with a bike box at Webster for left turns to Centre Street. *2015*

**Beals Street:** See Abbottsford Road.

**Beverly Road (SC)** is the main access to Baker School, and though it has medium traffic volume (3,549 AADT), it is a primary route for students and should have protected bicycle lanes. Children bicycling often use the sidewalk given the large number of fast-moving cars. This leads to conflicts with pedestrians. At a minimum, one lane is required from Independence Drive to the school, against the flow of cars during morning arrival. Positioning this bike lane towards the center of the road and allowing space for parked cars would also discourage drivers leaving the school

from treating the road as two lanes, trying to overtake slower cars. Ideally a bicycle lane would extend to Lagrange Street.

A traffic calming plan for Beverly Road that includes no parking zones, raised crosswalks, and restricts traffic turning from Independence Drive during school hours was approved in 2022.

**Blake Road (SC)** provides access to and from BHS. Traffic volume (3,632 AADT).

**Boylston Street / Route 9**

Washington/High Street intersection to Chestnut Hill (PF). Continue the cycle tracks west to Chestnut Hill, on this most heavily traveled and highest speed road in Brookline.

Chestnut Hill Avenue crossing (PF). Improve bicycle use and safety in this intersection by adding lanes connecting Chestnut Hill Avenue, Heath Street, and Lee Street.

At-grade crossing for Muddy River Path. Curbs reconfigured, median widened, traffic signal installed. *2016*

**Brookline Avenue (PF)**: Northbound combination marked bike lane and bus-bike lane from just north of Washington Street to town line. Southbound, buffered bike lane from Parkway Road to Pearl Street. Concept plan complete, awaiting approval from MASCO and MBTA.

**Brookline Avenue Path** Repairs, ramps to street at Aspinwall Avenue, and signalized crosswalks. *DCR 2018.*

**Buckminster Road (SC)** connects residential areas with Boylston Street, Chestnut Hill Avenue, and Beacon Street corridors, and with Runkle School and BHS.

**Carlton Street (PF)** provides important linkage between the BU Bridge and the Longwood Medical Area, as well as a connection to the soon-to-be-restored Carlton Street Footbridge. With its high traffic volume (9,619 AADT) it should have protected bike lanes in both directions. Carlton Street has bicycle lanes northbound between Beacon Street and Churchill Street and between Euston and Mountfort streets.

**Carlton Street Footbridge:** Repair and reopening of the Carlton Street Footbridge to provide a direct connection for bikes and pedestrians between the Muddy River Path and Carlton Street, including a safe crossing of Carlton Street at the footbridge site. Scheduled to open spring 2023.

**Centre Street (SC)** should have flex posts to prevent parking in the bike lane. At a minimum, more bike lane markers are needed.

Buffered bike lane southbound; sharrows northbound. Traffic signal at Beacon configured to be triggered by bikes. *2018*

**Chapel Street (PF)** should have protected bike lanes in both directions due to its traffic volume (9,605 AADT).

Painted bike lane northbound; sharrows southbound. Bike box for left turns from Chapel Street to Longwood Avenue; camera-activated turn signal. *2014*.

**Charles Street:** Allow contraflow southbound beyond the garage entrance to Sewall Avenue; then contraflow on Sewall Avenue to Longwood Avenue to provide safe access to the rear of businesses.

**Chestnut Hill Avenue between Boylston Street and Beacon Street at Cleveland Circle (PF)** is a major route from South Brookline to Dean Road, Clinton Road, and Beacon Street at Cleveland Circle. It is a high traffic street (17,007 AADT) and needs protected bike lanes in both directions. It is approximately 38 feet wide from Boylston Street to Clinton Road. Travel lanes In this area should be reduced to 10 feet wide to help reduce speed to the 25-mph speed limit. The rest of the lane width can be split evenly on both sides for protected bike lanes. From Clinton Road to Beacon Street, bike lanes should be continued with the car lane width reduced and the buffered area reduced or removed as necessary. In order to accommodate the bike lane, the additional northward car travel lane should begin at the entrance to the MBTA depot, where the road widens. Paint that directs bikes to cross the tracks in the safest way should be added.

Chestnut Hill Avenue at Clinton is a difficult crossing for bikes and pedestrians, with poor sight lines. A median refuge is recommended.

**Chestnut Hill Commercial District (PF):** This proposed project would help to make the Chestnut Hill shopping area safer and more accessible for bicycles. It takes advantage of the relative safety of both Middlesex Road on the north side of Boylston Street and Heath Street on the south. The project involves creating bike lanes on Hammond Street from Middlesex Road to the shopping center and then extending a bike path through the shopping center connecting to the traffic light at Tully Street, then to Heath Street and Hammond Pond Parkway. Some of the bike path would be built as a sidewalk extension. Coordination with the City of Newton is essential. An additional accommodation could be to re-stripe the Hammond Street/Boylston Street intersection to make it safer for bikes to go from Middlesex, across Boylston Street to a right turn on Heath Street.

**Chestnut Street (PF):** Portions of Chestnut Street are very high traffic (15,909 AADT) while other portions are moderate traffic (3,735 AADT). The high traffic section that connects Cypress and High Streets to Pond Avenue, Leverett Pond Path and Jamaica Plain at Paul Pender Rotary (a.k.a. Riverdale Parkway Rotary) needs

protected bike lanes. A two-way separated cycle track between Walnut and Kendall Streets was approved for Safe Routes to School funding in 2025. With reconfigured parking, bicycle accommodations could be extended along the entire length of Chestnut Street.

**Clark Road (SC):** Marked for bicycle priority lanes in both directions.

**Cleveland Road (SC):** This short road is an important connection between Eliot Street and Reservoir Road.

**Clinton Road (SC):** connects residential areas with Boylston Street, Chestnut Hill Avenue and Beacon Street corridors, and with Runkle School and BHS. Sharrows were painted between Buckminster Road and Dean Road in 2020.

**Clyde Street (PF):** The segment between Newton Street and Lee Street is part of the Protected Framework. Painted lanes on both sides. Intersection narrowed, and dedicated, protected slip lane added for bicycles turning right where Clyde turns south at Lee Street. *2017*

**Colchester Street:** Painted bike lane northbound. Sharrows on southbound lane.

**Coolidge Street:** See Abbottsford Road.

**Corey Road (SC)** provides an important connection between Beacon Street and Dean Road in the south, and Washington Street. With its medium traffic volume (3,952 AADT) and narrow width, it should have a bike lane or be traffic-calmed to 20 mph so that bikes can safely mix with motor traffic. Half this stretch of Corey is in Boston and half is in Brookline, so the treatment should be coordinated with the City of Boston.

**Cottage Street from Goddard Avenue to Warren Street (PF):** Bike lane or traffic-calmed to 20 mph to ease uphill travel for cyclists. For section of Cottage Street that merges with Goddard, see treatment for Goddard Road.

**Crafts Road (SC)**, along with Middlesex Road and Dean Road, connects Hammond and Boylston Streets in South Brookline with Cleveland Circle, Washington Square and other parts of North Brookline. With its medium traffic volume (3,630 AADT) and narrow width, it should be traffic-calmed to 20 mph.

**Cypress Street from High Street near the Jamaica Plain border to Washington Street (PF)** provides an important connection from south of Boylston Street to BHS and along with School Street, to all points north and east. Because it has a high volume of traffic (10,043 AADT), it should have protected bike lanes in both directions.

Painted bicycle lanes from Paul Pender Rotary to Boylston Street (*2013* ). Painted bicycle lane southbound from Searle Avenue to Brington Street (*2014).*

**Davis Avenue (SC):** Between Cypress Street and Washington Street, if a protected bike lane can be provided in only one direction, traffic should be calmed so that cyclists can ride in the traffic lane.

Contraflow from Greenough Street to Cypress Street. *Scheduled for 2023 construction*.

**Dean Road (SC)** connects Beacon Street with routes to Runkle School and BHS. With Crafts Road and Middlesex Road it also connects Hammond and Boylston Streets in South Brookline with Cleveland Circle, Washington Square and other parts of North Brookline. With its medium traffic volume (3,630 AADT), it should have protected bike lanes in both directions.

**Dudley Street and Dudley Way (SC):** Contraflow lane added along the south side of the Brookline Reservoir from Lee Street to Warren Street. *2013*

**Dummer Street** is just 24 feet wide along its 2,000-foot extent between Pleasant and Essex streets parallel to Commonwealth Avenue. Westbound, it carries heavy rush hour traffic from the BU Bridge into North Brookline. Eastbound it carries traffic to the BU Bridge and Commonwealth Avenue, so bike accommodations would be beneficial. The most heavily trafficked section is between Essex and Amory, where a westbound bike lane should be possible. The same treatment might be possible between Amory and Saint Paul, although there are loading docks perpendicular to traffic flow that might frequently block a westbound bike lane. Between Saint Paul and Pleasant, the street is used intensively for parking, with parallel parking for Brookline Housing Authority in the eastbound direction and commercial parking westbound.

**Eliot Street (SC):** With its medium traffic volume (3,630 AADT), protected bike lanes are recommended. If a protected bike lane can be provided in only one direction, traffic should be calmed to 20 mph in the other direction so that bikes can ride safely in the traffic lane.

**Essex Street (SC):** is an important through route connecting traffic across the BU Bridge from Cambridge to Boston and Brookline.

Protected contraflow bicycle lane between Commonwealth Avenue and Dummer Street. Buffered contraflow lane between Dummer and Worthington Street. Safety improvements at crossing of Dummer Street. *2019*

Curb cut in traffic island near Mountfort Street facilitates access to BU Bridge. *2013*

**Fisher Avenue (SC):** With its medium traffic volume (3,610 AADT), protected bike lanes are recommended.

**Freeman Street (SC):** Along with Babcock, Powell and Kent, Freeman Street connects residential areas north of Beacon with destinations south of Beacon. With its medium traffic volume (3,530 AADT) it should either have protected bike lanes or be traffic-calmed to 20 mph. Improve design of intersection with Babcock Street to slow vehicular turns. One possibility is to reconfigure and enlarge the small park to make one T-intersection of Freeman with Babcock rather than the two current intersections on either side of the park. Implement traffic calming to discourage cars from speeding to beat the traffic lights at Pleasant and Saint Paul Streets.

Four-way stop pedestrian phase at traffic signal at Freeman and Pleasant. Implemented *2020*.

**Fuller Street:** Painted contraflow lane between Gibbs Street and Abbottsford Road. *2019*.

**Gardner Road (SC)** is an important connector across Aspinwall Hill between Washington Street and Tappan Street.

**Goddard Avenue (PF),** in combination with Cottage Street from Goddard to the Jamaica Plain line, provides a direct connection between South Brookline and Boston at Jamaica Pond. It is narrow and winding. “Do not pass bicycles” signs could improve bicycle safety.

A half-mile-long bicycle lane is painted on the northbound (primarily downhill) side between Newton Street and Avon Street. Sharrows are painted on the southbound side. *2020*

**Green Street.** Contraflow lane installed. *2021*

Improvements to ‘bike walk’ adjacent to crosswalk connecting contraflow lane to Harvard Street southbound. *Planned for 2023 construction*.

**Greenough Street (SC)** is a critical access route to BHS as well as a direct route past BHS to Washington Street (and Washington Square) and Park Street (to Coolidge Corner). It should be traffic-calmed to 20 mph.

Parking-protected contraflow lane between Tappan Street and Davis Avenue. *Construction scheduled for 2023*

“Except bicycles” sign added to the restriction on Greenough Street in front of BHS.

Sharrows and curb extension between Washington Street and Lowell Street. *2017*

**Grove Street (HI/PF):** Bike lanes in both directions between Newton Street and the Newton line at Russett Road, through Putterham Circle. Because of high traffic volumes (9,646 AADT), bike lanes should be protected.

**Hammond Pond Parkway (PF)** is a DCR road with high traffic volume (9,634 AADT). It should have protected bicycle facilities along its 0.7-mile length in Brookline. A multi-use path could connect Newton, Brookline, and West Roxbury and provide recreational access to Brookline parks and conservation areas. DCR is constructing a two-way multi-use path in Newton between Beacon Street and Boylston Street. The 2020 DCR Parkways Master Plan has extensive recommendations for this road.

**Hammond Street (HI/PF)** is a critical thoroughfare through South Brookline, connecting West Roxbury Parkway with Boylston and Beacon Streets. Use a road diet for Hammond between the rotary and Boylston Street for one lane in each direction (except at Boylston Street junction); provide protected bike lanes in both directions; install additional crosswalks for safer pedestrian crossing at other points (e.g., near Dane Park and the Fire Station). For the stretch from Boylston Street north to the Newton town line, coordinate implementation with the City of Newton's improvements on Hammond Street north to Beacon Street.

Conceptual design for traffic signal and road diet at Hammond Street and Woodland Road *approved 2021, in the Capital Improvement Program for FY2025*.

**Harvard Street (HI/PF)** connects the JFK Crossing, Coolidge Corner, and Brookline Village commercial centers. It is a major north-south artery connecting with Allston and Cambridge to the north and Jamaica Plain to the south. It should have protected bike lanes in both directions along its entire length because of its high traffic volume (20,530 AADT). The recommendations for Harvard Street below should be considered short-term measures. A 2016 MassDOT report identified potential pedestrian and bicycle safety improvements in the Harvard Street corridor near Coolidge Corner. Several of the recommendations could be implemented on a short-term trial basis to quickly evaluate their effects. These include:

- Install additional bike parking or on-street bike corrals.
- Install pedestrian countdown indications at signalized intersections, such as Harvard and Beacon Streets.
- Extend leading pedestrian intervals at Harvard and Beacon streets.
- Install wayfinding signage on southbound Harvard Street north of Beacon Street to inform drivers of the need to position for a left turn onto Longwood Avenue prior to Beacon Street.
- Close the exit driveway from Centre Street parking lot onto Beacon Street at Babcock Street.

The left turn signal from Harvard Street southbound to Babcock Street should be triggered by a bicycle.

Surface mount bollards installed between Beacon Street and Green Street along the white lane line separating the bike lane and the right travel lane. 2023.

Painted bicycle boxes at all four corners of intersection with Beacon Street. *2019*

Bike parking corral near Green Street. *2019*

Painted bike lanes and sharrows from School Street to Beacon Street. *2013*

"Except bicycles" sign added to the "no right turn" restriction at intersection of Harvard and Washington Streets in Brookline Village. *2013*

**Heath Street (HI/SC)** runs east-west roughly parallel to Boylston Street from the Brookline Reservoir to the Newton border, with medium traffic volume (3,724 AADT). It is an attractive route for bicycle commuting, recreation, and shopping. Heath Street's width makes passing impossible without crossing substantially into oncoming traffic or without coming dangerously close to bikes. Signage should prohibit motor vehicle drivers from passing bicycles between Warren Street and Hammond Street.

Shared lane with sharrows between Woodland Road and Tully Street. *2020*.

**High Street between Chestnut Street and Cypress Street (PF)** has a high volume of traffic (9,999 AADT). The short section between Chestnut Street and Cypress Street links Cypress Street and points surrounding it to the Leverett Pond path and Jamaica Plain. Because of the high traffic volume, it should have protected bike lanes.

**Horace James Circle (PF)** is a high volume (16,364 AADT) major node connecting various high-volume routes in South Brookline. Provide a green carpet bike lane around the entire circle to the right of the motor traffic lane, and provide signs for motor vehicles to yield to bicycles. On all approaches where bike lanes or wide shoulders are dropped, mark the merger with stripes, green paint, bike symbols, and signs for motor vehicles to yield to bikes.

**Independence Drive (PF):** Bike lanes in both directions between Putterham Circle and Town line to improve safe access to Baker School. Because traffic levels are high (10,022 AADT) bike lanes should be protected.

**Ivy Street:** Painted contraflow lane. *2019*

**Kennard Road (SC)** provides an important connection to Lincoln School. With its medium traffic volume (3,735 AADT) and narrow width, it should be traffic-calmed to 20 mph so that cyclists can safely mix with motor traffic. On school days, parked cars occupy much of the northbound lane from Walnut Street to Boylston Street. There is no shoulder and limited room for bicycles. The Town should consider limiting parking or making Kennard Road one-way and adding a two-way protected bike lane.

**Kent Street (SC),** along with Babcock, Freeman, and Powell, connects Brookline Village and other areas south of Beacon Street with areas north of Beacon.

**Kenwood Street:** See Abbottsford Road.

**Lagrange Street, Horace James Circle to Town Line (PF)** is wide with room for bike lanes in both directions, due to high traffic volumes (9,912 AADT) bike lanes need to be protected.

**Lee Street (HI/PF):** Lee Street is a major route between south and north Brookline. Because of high traffic volumes (9,837 AADT), it needs protection. A major project could create a "greenway" on Lee and continued onto Clyde Street by moving motorized traffic to the west side (one lane in each direction) and constructing a mixed-use path and service road on the east side. In the short-term reduce the motor traffic lane width and use the freed width to buffer and protect the existing bike lanes; where the bike lane is dropped as Clyde approaches Newton, mark the merger with stripes, green paint, bike symbols, and signs for motor vehicles to yield to bikes.

**Longwood Avenue (PF)** is a major high traffic (9,600 AADT) connector between Brookline and the Longwood Medical area. It needs protected bike lanes in both directions. Enhance the bike lane toward the Medical Area through the Chapel Street intersection to the bridge across the Muddy River by narrowing the motor traffic lanes and separating them from the bike lane with a buffer zone and flex posts or other barriers to prevent cars from using the bike lane as they queue up waiting for the Riverway light to turn green. Buffer the bike lane along the entire length of Longwood where feasible.

The left turn from Longwood Avenue southbound onto Chapel Street (toward the Longwood T-stop, the ramp to the Muddy River path and Longwood Towers) is both heavily used and difficult for bike users and motor vehicle drivers because traffic moves steadily on Longwood from the Longwood Medical Area. Although there is a light at this intersection, left turning traffic has no opportunity for a protected turn. Bikers waiting to turn have moving traffic on both sides of them. It would be beneficial to have an option to allow bicycles and other vehicles queued at the light to turn left without oncoming traffic at the beginning of the light cycle. Install don't block the box street markings in the intersection.

The Transportation Division expects to begin study for a major redesign of Longwood Avenue in 2023.

Bicycle lane marked eastbound; bicycle priority lane marked westbound. *2010 and 2013*

**Marion Street (SC):** With its medium traffic volume (3,499 AADT) and adequate width (33 feet), the one-way portion of Marion Street should have protected bike lanes in both directions. The two-way portion should either have protected lanes in both

directions or be traffic-calmed to 20 mph so that cyclists can safely mix with motor traffic.

**Marion at Beacon Street:** Traffic signal to allow left turn onto Beacon Street should be triggered by bicycle.

**Middlesex Road (SC)** is an important link for travel to and from the Chestnut Hill commercial district. Four essential parts are recommended. First, contraflow from Circuit Road to Reservoir Road. Second, bicycle priority lanes between Hammond Street and Circuit Road. Third, a curb ramp to access the Reservoir Road Bridge from the reservoir side over the D line, which is in Boston. Finally, with its medium traffic volume (3,696 AADT), Middlesex Road should be traffic-calmed to 20 mph so that bikes can safely mix with motor traffic.

**Mountfort Street (PF):** This short street is part of the major traffic connection between Beacon Street and the BU Bridge. It is the third most heavily trafficked street in Brookline (29,000 AADT). A protected bicycle lane should be installed for the entire length of Mountfort in cooperation with Boston since the street crosses the town line.

**Monmouth Street (PF):** Move parking to north side of street and allow contraflow from Hawes Street to Saint Mary's Street.

**Naples Road:** Bike lane painted on north side *without* a double yellow center line; absence of a center line has been shown to slow traffic. *2019.*

**Netherlands Road:** The Town's first contraflow lane from Parkway to Aspinwall was installed here in 2009.

**Newton Street (HI/PF):** This wide street with high volume and fast-moving traffic is used by commuters and recreational riders traversing South Brookline between Newton and Boston.

A Newton Street Greenway would provide protected bike facilities along all high traffic stretches from the eastern end at Pond Street, through the intersections with Goddard Avenue, Clyde Street, Grove Street, South Street, West Roxbury Parkway, and Horace James Circle to the Newton line. Safe crossing is needed at South Street with either a median refuge for bicycles and pedestrians and/or traffic signal to allow safe access to Putterham Circle, Independence Drive, and VFW Parkway. Along Putterham Golf Course, a major project would create a "greenway" by moving motorized traffic to the west side of the separated parkway (one lane in each direction) and constructing a mixed-use path and service road on the east side. Intersections will need to be redesigned. The 2020 DCR Parkways Master Plan identifies similar proposals along the portion of Newton Street paralleling West Roxbury Parkway.

From Goddard Street to the Boston line at Saint Paul's Avenue. A 0.4-mile bicycle lane was painted along both sides of the street. *2020*

From Clyde Street to Goddard Avenue, buffered bike lanes, including bollards along both sides and a bike box at Goddard. *2019*

From Horace James Circle to Newton town line, painted bike lanes. *2017*

**Norfolk Road (SC):** With its medium traffic volume (3,750 AADT) and narrow width (24 feet), Norfolk Road should be traffic-calmed to 20 mph so that bikes can safely mix with motor traffic.

**Park Street (HI/SC)** connects North Brookline to BHS and Brookline Hills area. It offers a quieter alternative to bicycling on Harvard Street. With its medium traffic volume (3,621 AADT) and narrow width (26 feet), it should be traffic-calmed to 20 mph so that bikes can safely mix with motor traffic.

No parking restriction 7-9 AM, westbound, Harvard Avenue to Washington Street. *Implemented 2019.*

Contraflow lane from Marion Street to Beacon Street *2013*

**Parkway Road:** contraflow lane from Brookline Avenue to Netherlands Road. *2009*

**Pearl Street (SC):** Raised cycle track from Brookline Avenue to raised crossing at the Brookline Village T-stop; buffered bike lane from the raised crossing to Brookline Avenue. Sharrows in both directions between T-stop and Washington Street. Traffic signal installed at intersection of Pearl Street and River Road/Emerald Necklace Path. *2019*

**Pleasant Street (SC)** is 25 feet wide, has parking on the east side, and two-way traffic for most of its length. Between Waldo and James Streets, Pleasant is about 30 feet wide and has parking on both sides between Waldo and John Streets. Riding northbound, bikes are in the door zone or in traffic. With its medium traffic volume (3,543 AADT) and narrow width, Pleasant Street should be traffic-calmed to 20 mph so that cyclists can safely mix with motor traffic.

At the intersection with Beacon Street, provide a green contraflow bike lane on the one-way section of Pleasant from inbound Beacon across the MBTA tracks, across the outbound side of Beacon Street to Waldo Street. This would provide a more direct turn from Beacon Street inbound onto Pleasant Street for bicycle users (a frequent maneuver) and better visibility as bikes join the traffic flow on Pleasant Street northbound. These changes should be coordinated with changes to the traffic signal timing/coordination to ensure greater safety for pedestrians and cyclists using the intersection.

**Powell Street (SC),** along with Babcock, Freeman, and Kent Streets connect Brookline Village and other areas south of Beacon Street with areas north of Beacon. With its medium traffic volume (3,392 AADT) it should either have protected bike lanes or be traffic-calmed to 20 mph.

**Puddingstone Road** is one-way from West Roxbury Parkway to South Street and provides a route from the Putterham Library crosswalk across the Parkway towards Baker School that avoids the Putterham rotary. Contraflow bicycle travel would allow safe use of the road in the opposite direction.

**Reservoir Road (SC)** provides access across Boylston Street, and between Boylston Street and Beacon Street. It also passes alongside the Heath School, allowing bicycle and walk access from the west. With its medium traffic volume (3,645 AADT) it should either have protected bike lanes or be traffic-calmed to 20 mph. In addition, the intersection with Boylston Street should be engineered to allow bicycles to cross safely.

**River Road/Muddy River Path:** Muddy River path paved along River. *2016*

**Russell Street:** See Abbottsford Road.

**Russett Road** serves Baker School students who already bike from the neighborhood on the south side of Independence Drive as it leads to a supervised crossing of Independence Drive. The street should be traffic-calmed to 20 mph so that bicycles can safely mix with motor traffic.

**School Street from Harvard Street to Washington Street (PF)**, and Cypress Street, provides an important connection from north Brookline to BHS and areas south of Boylston Street. Because it has a high volume of traffic (10,043 AADT), it should have protected bike lanes in both directions.

Repaved from the public parking lot to Washington Street to remove dangerous hump. *2012*.

Bike priority lanes painted from Washington Street to Harvard Street. *2014*

**Saint Mary's Street (SC)** links neighborhoods in North Brookline with the Saint Mary's commercial district and MBTA stop. Along with Ivy Street and others, it provides access to Commonwealth Avenue and across the BU Bridge to Cambridge. It has medium traffic volume (3,648 AADT) and a narrow width (27 feet).

Plan to stripe and sign contraflow lane for bicycles from Mountfort Street to Commonwealth Avenue upon completion of Saint Mary's Street bridge project. MassDOT has included with flow and contraflow bike lane striping on the Saint Mary's Street bridge. *Pending construction by MassDOT 2023*.

Sharrows painted in both directions between Beacon Street and Mountfort Street. *2019*.

**Saint Paul Street (PF)** provides a major connection between Brookline Village and Allston. Given its high traffic volume (16,889 AADT), protected bike lanes are needed in both directions.

Developing submittal for reconstruction as part of the Town's American Rescue Plan Act funding. *2022*.

Beacon Street to Commonwealth Avenue. Surface repatching including bicycle lanes. *2021*

Painted bicycle lane northbound from Aspinwall Avenue to Commonwealth Avenue. Painted bicycle lane southbound between Browne Street and Parkman Street. Sharrows on other southbound segments. *2015*.

"Except bikes" signs added to the "No turn on red" signs at Beacon Street intersection. *2015*

**Sewall Avenue:** Provide contraflow from Charles Street to Longwood Avenue to access businesses without using Beacon Street.

**Somerset Road (SC):** With its medium traffic volume (3,632 AADT) and narrow width (24 feet) Somerset Road should be traffic-calmed to 20 mph. In addition, the one-way portion should have a protected contraflow lane.

**South Street (SC)** provides a north-south link between Newton Street and West Roxbury that has far less traffic than West Roxbury Parkway. With its medium traffic volume (3,506 AADT) and narrow width (24 feet) South Street should be traffic-calmed to 20 mph so that bikes can safely mix with motor traffic.

**Station Street (SC)** and Kent Street, both of which are one-way (in opposite directions) near Washington Street in Brookline Village, together provide access between Brookline Village and neighborhoods to the north via Kent Street. With its medium traffic volume (3,890 AADT) it should be traffic-calmed to 20 mph. However, because Station Street is one-way, bicycle access from Kent Street to the Brookline Village MBTA station is awkward. Therefore, a protected contraflow lane is needed. Also, replace the cobblestone crosswalks, which pose a hazard to bike users, with raised crosswalks or other alternate treatments.

**Stedman Street:** Provide safe contraflow from Harvard Street toward Gibbs Street, considering the entire right of way width. This might be accomplished by a protected contraflow bicycle track, or by a multi-use path for both bicycles and pedestrians. This is important for the safety of students who must otherwise bike to

Harvard Street and interact with busy traffic. The traffic signal at Stedman and Harvard should be triggered by a bicycle.

**Summit Avenue (SC)** provides access for residents of the Corey Hill neighborhood to Beacon Street and to Brighton. With its medium traffic volume (3,941 AADT) and narrow 26-foot width, Summit Avenue should be traffic-calmed to 20 mph.

**Sumner Road (SC)** provides access to BHS from the south and west. It also provides access to South Brookline from the Aspinwall Hill neighborhood. It has medium traffic volume (3,632 AADT) and should be traffic-calmed to 20 mph so that bikes can safely mix with motor traffic. At the intersection with Boylston Street, the traffic signal should be triggered by a bicycle and the intersection should be engineered to allow safe bicycle crossing. In the one-way section between Greenough and Blake a protected contraflow lane should be provided to allow direct egress from BHS to the southwest.

Bike lane between Buckminster Road and Boylston Street. Shared vehicular right turn with through bike lane at Boylston Street. Sharrows between Buckminster Road and Clark Road. *2014*.

**Tappan Street (SC)** provides access to BHS from the northwest and facilitates movement among BHS campus buildings. With its medium traffic volume (3,603 AADT) and narrow width (26 feet) it should be traffic-calmed to 20 mph so that cyclists can safely mix with motor traffic. Of special concern are two sections with poor sight lines on the inside of blind curves in the northwest direction from Blake Road to Gardner Road and from approximately 260 Tappan Street to Garrison Road. A protected contraflow lane is needed from Blake to Greenough to allow direct access to the campus from the northwest.

Buffered contraflow bicycle lane on Tappan Street between Greenough Street and Cypress Street. *Planned for 2023*.

**Thorndike Street:** See Abbottsford Road.

**Verndale Street:** See Abbottsford Road.

**Vernon Street (SC):** With medium traffic volume (3,499 AADT) and narrow width (22 feet), Vernon Street should be traffic-calmed to 20 mph so that bikes can safely mix with motor traffic.

**Walnut Street (SC):** With its medium traffic volume (3,731 AADT) and narrow width (24 feet), Walnut Street should be traffic-calmed to 20 mph so that bikes can safely mix with motor traffic.

New traffic signal at intersection of Walnut and Washington Street allows for bicycle and pedestrian crossing of Boylston Street. *2020*

**Warren Street (SC)** is narrow and winding with no shoulder. It is a principal route to Lincoln School and BHS. The intersection with Walnut Street at the Town Green is particularly challenging. At the intersection, Walnut Street should be made one-way westbound north of the Green and one-way eastbound south of the Green. Accommodations should be made for safe two-way bicycle travel on the section between Walnut Street and Boylston Street. Warren Street should be traffic calmed to 20 mph from Boylston Street to the eastern end of Dudley Street. This street was added to the Plan network in 2022.

**Washington Street (HI/PF)** is a major artery connecting Driscoll School, Pierce School, the Main Library, Town Hall, the Public Safety building, and two commercial districts. It connects to BHS via the recently improved Greenough Street. It intersects both the C Line and the D Line and is served by the Route 65 bus. It is heavily used by motor vehicles, public transit, bicycles, and pedestrians. Excluding the Route 9 section, traffic ranges between 9,844 and 17,476 AADT.

A major Complete Streets redesign of Washington Street from Brookline Village to Beacon Street began in 2020. The project is expected to go through the MassDOT design process to secure federal transportation improvement program funds. A member of the bicycling community has been appointed the Design Review Committee. The project has a long timeline and construction will not begin until at least 2026.

Repairs to the road surface in the bicycle lane from Cypress to Beacon performed as part of the bonded wearing course contract to treat the surface and extend life five years while the Town goes through development process. *2022*.

In 2020, curb-protected cycle track and bicycle traffic signals were installed along 900 feet of Washington Street (Route 9) in Brookline Village in either direction under the Gateway East project funded by federal Transportation Improvement Program funds. Bicycle traffic signals were installed along the track. Signal timings were adjusted following a study conducted in cooperation among BAC, the Transportation Division, and Professor Peter Furth. *2021-2022*

Bicycle lanes and sharrows painted from the intersection of School and Cypress Streets to the town line. *2013*

Bicycle lanes and sharrows from Davis Avenue to intersection of School and Cypress Streets. *2010*

**Webster Street (SC)**, with its medium traffic volume (3,485 AADT), should be traffic-calmed to 20 mph so that bicycles can safely mix with motor traffic. The existing traffic calming should be verified by speed measurement.

**West Roxbury Parkway (PF)** is **c**ontrolled by DCR. It has high traffic volume (21,927 AADT), and connects to Putterham Library, Baker School, and West Roxbury. The 2020 DCR Parkways Master Plan presents comprehensive recommendations for adding bicycle accommodations along the 1.2-mile length of the road in Brookline. In the interim, parking restrictions in the wide shoulder could improve bicycling conditions.

**Westbourne Terrace:** Install two-way raised cycle track adjacent to sidewalk from Bartlett Street to Beacon Street on the west side of street nearest to the school to improve access to Driscoll School without increasing conflicts with cars dropping off students at the Westbourne terrace entrance.

Bike lane between Beacon Street and Bartlett Street *planned as part of Driscoll School renovation, 2023.*

**Williams and Centre Street:** Change signalized intersection to stop-controlled intersection.

**Willow Pond Road:** Bicycle accommodations should be provided to make a safe connection through Olmsted Park, connecting bike paths on the two sides of the park. (Would require cooperation with DCR and with Boston because the road crosses the town border.)

**Winchester Street (SC)** provides important access from Coolidge Corner neighborhoods to Brighton. With its medium traffic volume (3,994 AADT) it should have protected bike lanes in both directions or be traffic-calmed to 20 mph so that bicycles can safely mix with motor traffic.

A painted bike lane was installed from the Town line to Beacon (southbound side); speed humps were reconfigured to be gentler. Crosswalks installed at Williams and Wellman; removed 6-8' of parking at Fuller and Williams Streets to improve sightlines. Established 20 mph safety zone in both directions around Senior Center. *2019.*

**Woodland Road (SC)** from Heath Street near Hammond Pond Parkway to Hammond Street is a wide, relatively quiet residential street without curbs or consistent sidewalks; there are large trees at the road's edge on both sides for its whole length. It does not warrant bike lanes, except as it approaches the intersection with Hammond Street. From Hammond Street to Heath Street (near Pine Manor College), Woodland is a one-way street that is a highly used motor vehicle cut through. The feasibility of installing a protected bike lane should be explored. If that is not feasible, it should be traffic-calmed to 20 mph so that bikes can safely mix with motor traffic.

Conceptual design for traffic signal and road diet at Hammond Street and Woodland Road *approved 2021, in FY2025 Capital Improvement Program*.

# Appendix C: Micromobility

Micromobility technology, including bicycles, skateboards, scooters, wheelchairs of all types, and other devices for people with mobility limitations, is rapidly changing and becoming increasingly popular. Users of these modes frequently rely on bicycle accommodations, emphasizing the growing need for dedicated and protected bicycle infrastructure and parking. Micromobility vehicles are generally much lighter than conventional motor vehicles and are typically designed for one user. There is no unique definition of the term; the category usually includes bicycles, e-bikes, scooters, electric scooters, skateboards, electric skateboards, shared bicycles, and electric pedal-assisted (pedelec) bicycles. Definitions often focus on shared use rental bicycles and scooters as a means of traveling the "last mile," such as from a transit stop to a destination.

Motorized micromobility vehicles generally use electric power or can be pushed/pedaled. A typical ebike or e-scooter allows travel up to 15-20 mph, faster than most bicycles, especially uphill.

Increased use of micromobility vehicles is concomitant with increased diversity of age groups, physical conditions, road awareness, and experience. Motorized micromobility vehicles need charging facilities, whether standalone or combined with electric motor vehicle charging stations.

E-scooters are gaining popularity worldwide through private ownership and via shared mobility systems. In some cities, e-scooter use is outpacing bicycle use in shared systems. Brookline conducted a pilot program of shared electric scooters from April through November 2019. The program generated 200,000 trips by 20,000 users, an average of nearly 1,000 daily trips. Approximately 20% of these trips replaced motor vehicle trips. Most scooters users were satisfied with their operation. The program also generated complaints about safety and confusion about shared spaces including sidewalks and roadways. Massachusetts laws regarding electric scooters are not well established and the pilot was not extended.